THE

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ELECTRICAL REVIEW.

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MOTOR PROBLEMS.

OUR article on this subject, as we expected, has elicited some useful information, but we are not prepared to admit that the problems we propounded are appreciably nearer a solution. We are interested to observe that both of them are receiving attention, and we hope that eventually they will be satisfactorily solved. Lieut. Durtnall's letter held out hopes of the introduction of an A.C. induction motor capable of continuous variation of speed, which we shall be glad to see fulfilled; and Mr. Mould drew attention to a simple device which his firm had developed to meet the difficulty which we described, besides imparting interesting and practical information on the stopping of motors and machinery. To what extent the vibrating relay satisfies the conditions of simplicity and cheapness, combined, of course, with efficiency and reliability in operation, is a question which we are not in a position to answer; but if it is satisfactory in these respects, we shall gladly award the palm to this device.

It may be of interest to add to our previous remarks that experiments have been made by an engineer who is deeply interested in this matter, from the user's point of view, to investigate the phenomena which take place under the conditions which we outlined. On connecting five or six 230-volt lamps in series across the terminals of the motor, it is frequently found that when a quick stop is made with the motor running at full speed, these lamps flash up to full brilliance. This applies both to motors controlled by means of starters of the ordinary radial type, with a separate lever for shunt control, and to those provided with a drum controller fitted with substitutional resistances. In the case of a 75-H.P. motor driving a calendar, the armature insulation was pierced; there was a clean puncture through the tapes and mica, but little arcing was noticed, probably because by the time the puncture had taken place the speed of the motor was rapidly falling and the generator effect was dying out. This, we understand, is by no means the only instance of a motor breakdown from this cause within the experience of our informant. Impregnation of the armature windings appears to afford no real remedy for this trouble—nor, indeed, is it intended for that purpose—but the nature of the risk emphasises the importance of making a thoroughly sound job of the insulation of variable-speed machines.

Our reference to the possibility of the E.M.F. of a 460-volt motor rising to more than 2,000 volts was based upon the view that when the supply circuit was interrupted, under the stated conditions, not only would the field be excited to the full normal value, but owing to the high armature E.M.F. being applied to the shunt terminals, the field excitation might be increased considerably above the normal maximum value, thus producing a cumulative effect on the armature E.M.F. This was a speculative assumption on our part, but we were interested to learn from our experimenting friend that after reading our remarks he put the matter to the test, and found that in the case of a 20-H.P. motor, of which the normal full field current was 0·5 ampere, if the controller handle was brought to the off position when the motor was running on load, the current in the shunt winding rose to 0·8—1·2 amperes, the actual value depending on the speed with which the controller handle was moved. This result was entirely in accordance with our supposition. While the magnetisation of the field magnets would, of course, rise to a far less extent, depending upon the degree of saturation of the iron, it is obvious that a 100 per cent. increase in the shunt current is bound to produce a considerable effect upon the armature E.M.F., and this reaction tends materially to prolong the duration of the high-voltage period, whilst the armature is falling in

speed. The rise in the shunt current depends largely upon the loading of the motor; if the moving parts possess much inertia, and the motor speed is maintained for an appreciable period, the shunt current attains a correspondingly high value; if the speed falls quickly, the increment in the shunt current is less, but apparently there is always an increase to some extent.

Clutches, brakes, &c., are all good in their way, but add to the cost of installation and maintenance. The cost of the controlling apparatus of electric motors has always seemed to form an unduly large percentage of the total cost. What we had in mind was the ideally simple regulator handle of the steam locomotive, the nearest approximation to which is the drum type of controller, which stands rough usage and is said to be preferred to the radial type by machine minders or operators. Our information is that, apart from the merits of the devices at present on the market to meet the conditions which we described, their cost is a serious consideration. The push-button type of control, for example, is ideal, and can be carried out to meet any set of conditions; but it must be admitted that it is expensive, and while the ordinary works electrician can keep a plain drum controller in order, some of the more highly developed "automatic" systems call for the services of a highly skilled technical expert.

The solution to our problem should be mistake-proof, and capable of being handled in one way only, without fear of any undesirable result. In these days of piece-work and relatively high output, the number of manual operations required to start and stop motor-driven machinery must be reduced to a minimum. What is needed is the simplicity of the tramway controller—one operating handle only, capable of being moved forward as quickly as safe loading of the motor will permit, and backward as quickly or as slowly as the needs of the machinery require, and, above all, cheap and reliable.

Electrical Power Engineers.

We note with pleasure that the turbulence which has lately reigned in the breasts of power station engineers has subsided, and is being followed by a holy calm. The E.P.E.A., fortified by the fact that possession is nine points of the law, has secured official recognition as the representative Association for the protection of the interests of the technical staffs in power stations, public and private, and peace reigns once more. Without discussing the merits of the rival movements, we may express ourselves entirely satisfied with the essential feature of the matter—namely, the survival of *one* representative body, and no more. From the very first, knowing the strength of the position held by the E.P.E.A., we have urged that rivalry should be avoided, and that some means should be sought of securing co-operation in this sphere. In June the situation became serious, and it was evident that unless some drastic step were taken there would be a most regrettable division of forces which would result in the permanent weakening of the Associations concerned. Fortunately, the President of the I.E.E. saw the danger, and had the moral courage necessary to cut the Gordian knot; he frankly recognised that a mistake had been made, and promptly rectified it before it became irreparable. Nothing is more difficult than to tackle such a situation and to deal with it entirely from the point of view of the greatest good for the greatest number, without regard to one's own interests or to the susceptibilities of individuals; but Mr. Wordingham was equal to the occasion, and succeeded in averting a calamity.

We now learn that the Chief Technical Assistants' Association is working in hearty co-operation with the E.P.E.A.; its members will become members of that Association, but the C.T.A.A. will retain its separate identity for the purpose for which it was established—namely, the exchange of information among the senior men in electricity works—so that if, for example, a member makes a new departure in any branch of power-station practice, he will be fortified with the accumulated experience of his brother engineers, and will not have to make all their mistakes over again. That is as it should be; it is the spirit which must pervade the whole of our industries in the future, for only by the aid of whole-hearted co-operation can we hope to triumph in the trade war.

The E.T.U. and the E.P.E.A.

Since writing the above notes, we have realised with regret that the peace which reigns is not complete—there is still a certain amount of animosity between the E.P.E.A. and the E.T.U. The latter (as will be seen from our "Notes") refuses to recognise the *bona fides* of the E.P.E.A. as a Trade Union, objects to its representing the power station engineers in official conferences on wages, and, in effect, claims for itself alone that privilege.

We may point out (1) that the E.T.U. recognised the eligibility of the technical staffs for membership of a Trade Union, and indeed welcomed them into its ranks with open arms; (2) that any body of men whatever has an inalienable right to combine for its own purposes; (3) that the power-station men have elected to follow this course, and being eligible for membership of a Trade Union, they have duly formed one (the E.P.E.A.), and registered it as such. Hence, the E.T.U., in opposing the attendance of delegates from the E.P.E.A. at Conferences, has not a leg to stand on—it is throwing overboard the fundamental principles of Trade Unionism, and denying to others the rights and privileges which its own members enjoy.

This policy is bound to fail. We have always given the E.T.U. a fair field in our pages, and we have received official acknowledgments to that effect both publicly and privately; in this instance we do not hesitate to condemn its attitude towards a brother Trade Union as un-English, unsportsmanlike, and unjustifiable, and we trust that its leaders will speedily realise that selfish manœuvres designed to magnify the importance of the E.T.U. at the expense of the E.P.E.A., and entailing the sacrifice of goodwill and collaboration, not only are unpatriotic at this time, but also, being opposed to unity of purpose, weaken both parties.

Electrical Development in Holland.

According to an article published in a Dutch economic journal, Holland will be confronted with a serious problem after the war in the matter of the supply of coal, which will be very difficult to obtain, and very costly, so that the Dutch industries will be placed at a disadvantage as compared with those in other countries. The author states that previously to the war many Dutch industries were indebted for their development to the low prices of German coal, but the conditions will be quite different after the conclusion of peace, as Germany will know how to prevent the delivery to Holland of coal at such low prices as to create an unpleasant competition in industry and shipbuilding, apart from the necessity for levying taxes of all kinds, including one on the export of coal, in order to raise revenue. The author considers, too, that it will be impossible to procure cheap coal from Great Britain, and that this country also will impose a tax on the export of coal. Taking all the points into consideration, it is argued that the Dutch Government must do everything to support the native industries, and that these efforts will not be in vain. In this connection it is suggested that the use of electric power has a great future. The total production in Holland is stated to have increased from 135,000,000 KW.-hours in 1913 to 161,000,000 in 1914, 196,000,000 in 1915, and 260,000,000 KW.-hours in 1916. The State Commission of 1911 on the supply of electricity estimated the consumption at 321,000,000 KW.-hours per annum, but this quantity is now considered to be too low, as the Association of Managers of Electricity Works is of opinion that a demand for a minimum of 1,000,000,000 KW.-hours will arise in the near future. The question whether the business should be undertaken by a public or a private concern has already been decided in favour of the former system. The problems remaining to be settled are whether the works should be owned by the State or by combinations of the provincial authorities, and whether the works should be carried on by the owners or by companies in which the majority of the shares would be held by public authorities.

THE PORT ELIZABETH ELECTRICITY WORKS, SOUTH AFRICA.

Port Elizabeth being the venue for the next Convention of the Municipal Electrical Engineers' Association (Union of South Africa), some particulars of the Municipal electricity undertaking may be of interest to readers both in South Africa and elsewhere.

The supply was officially started on Tuesday, May 1st, 1906, by the Mayor of Port Elizabeth, Mr. Alexander Fettes, as a three-wire, direct-current supply at pressures of 500 and 250 volts, and the first installation of plant consisted of three Babcock & Wilcox marine type water-tube boilers, three Brush-Parsons 400-kw. turbo-generators with surface

Fig. 1.—Port Elizabeth Electricity Works.

condensers and electrically-driven auxiliaries, an E.P.S. storage battery, and main switchboard supplied by Spagnoletti & Co.

The buildings were designed by the late City Engineer, Mr. A. S. Butterworth, and the original scheme by Mr. Pape, the first City Electrical Engineer, Messrs. Robert Hammond & Son being the consulting engineers. Mr. Pape was succeeded in 1907 by Mr. H. J. Holder. During the succeeding years steady progress was made, and in December, 1912, Mr. Holder reported that further extensions would be required, in connection with which Mr. Holder, early in 1913, came to England. In May, 1913, Mr. Holder, whilst on leave, met with a serious accident, and Mr. B. Sankey was appointed assistant electrical engineer, and arrived at Port Elizabeth in October, 1913, to carry on during Mr. Holder's absence, and to proceed with the preparation of the scheme of extensions. In January, 1914, Mr. Sankey was appointed City Electrical Engineer, Mr. Holder being unfortunately incapacitated from further service, and in February, 1914, the new scheme, estimated to cost £50,000, was presented to the Council and finally adopted, with the approval of the consulting engineers, Messrs. Robert Hammond & Son.

The new plant involved an extension of the main buildings, designed and carried out by the city engineer and his staff, and the installation of the following machinery :—

Boiler-House Plant.—Two Babcock & Wilcox marine type water-tube boilers, each complete with superheaters, economisers, and chain-grate stokers, and having a normal evaporative capacity of 15,000 lb. of steam per hour; working pressure, 200 lb. per sq. in.; one B. & W. coal conveyor, having a capacity of 40 tons of coal per hour, and four overhead coal bins: main and branch steam and feed piping. The whole of this plant was erected and set to work by Messrs. Reunert & Lenz, of Johannesburg, the S.A. agents of Messrs. Babcock & Wilcox.

Engine-Room Plant.—Two 1,000-kw. Fraser and Chalmers steam turbines, with Worthington condensers and rotary pumps driven by 40-h.p. B.T.H. three-phase motors direct-coupled to Dick, Kerr alternators, 6,600 volts, three-phase, 50 periods, supplied and erected by Messrs. Fraser & Chalmers, Ltd.; one remote mechanically-controlled h.t. switchboard, supplied by the British Thomson-Houston Co., Ltd., and erected by their S.A. representatives, the S.A. General Electric Co. This board contains three machine panels, one summation panel, one converter panel, and four feeder panels, and stands on the switchboard gallery some 4 ft. above the engine-room floor level, the switchgear cubicles being housed in the basement below.

Sub-Station Plant.—One 500-kw. Bruce Peebles-La Cour motor-converter at the power station; one similar 250-kw. set at the Town Hall sub-station. These were supplied, erected, and set to work by Mr. J. W. Saaler, the S.A. representative of Messrs. Bruce Peebles & Co.

In addition to the above plant supplied under the extension scheme, it was found necessary to replace the main storage battery, and it was decided to substitute therefor one 450-b.h.p. Browett-Lindley compound engine direct-coupled to one 250-kw., 6,600-volt, three-phase alternator and one 200-kw., three-wire dynamo and exciter supplied by the Electric Construction Co., Ltd., of Wolverhampton. This set was fortunately secured prior to the main machinery, and has proved invaluable, having on two occasions run for six weeks without a stop. It is now used regularly for night work and week-ends, and beyond one general examination and a few minor adjustments, has cost nothing for repairs after two years' hard work, all bearings, piston rings, packings, &c., being in perfect order and commutation or slip-ring troubles being unknown.

Mains and Sub-station Switchgear.—The high-tension and telephone cables were supplied by Messrs. W. T. Glover and Co. through Messrs. Davis & Soper, London, and were laid, jointed, and tested by the municipal staff under the supervision of Mr. L. F. Bickell, the assistant engineer, the whole of the sub-station switchgear, transformers, &c., being similarly erected, tested, and set to work. The new

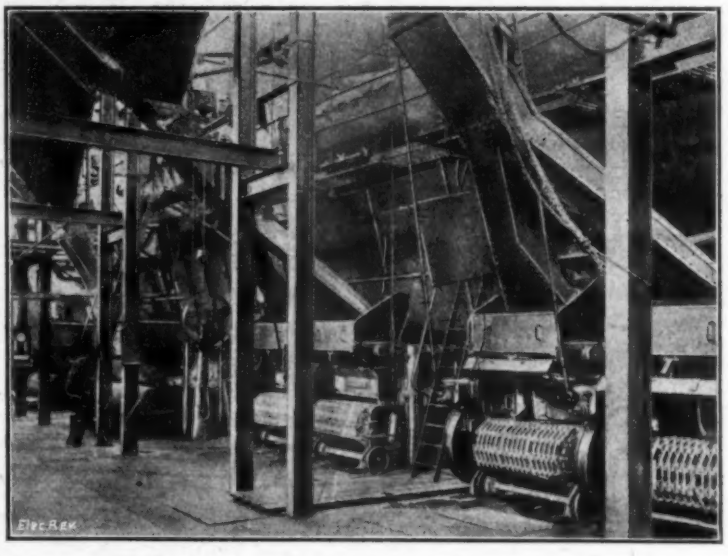

Fig. 2.—Boiler House; Two original Boilers in Foreground and two new ones beyond.

h.t. mains system includes several features worthy of note. Port Elizabeth stretches for nearly five miles along the shore of Algoa Bay and inland towards the centre of the town some 2½ miles. The main business portion of the town is in the centre, and this portion will continue to be supplied on the three-wire d.c. system, the original supply being supplemented by the 250-kw. motor-converter at the Town Hall sub-station. The rest of the town is being divided into districts, each to be

fed by a static transformer sub-station as follows: Humewood, the seaside portion at the extreme south of the Bay; South End, Cape Road, the inland district; and North End, the factory area adjacent to the works. In this latter area sub-stations are now being erected to supply 500-volt, three-wire, three-phase general power supply to overhead lines, and one large factory is already supplied from its own transformers. Consumers now using 500-volt D.C. in this area are being changed over to 500-volt three-phase supply, the existing D.C. mains being seriously overloaded.

In the other districts, which are mainly residential, single-phase transformers are being used to transform down to 500 and 250 volts, single-phase, three-wire, and the existing D.C. distributors are being changed over to single-phase, three-wire; 500 and 250-volt D.C. motors are being changed to Century single-phase commutator motors suitable for either 250 or 500 volts. It is interesting to note that on the sea front, where constant troubles were experienced through the corrosion and breakage of overhead-line wires, with an A.C. supply the trouble has almost entirely ceased. On all H.T. cable routes a Key fibre conduit has been laid to provide for future duplication, and also all sub-stations are interconnected *via* the power station by underground telephone cables, which are also used to operate a time clock system. This private telephone system has proved a great boon, especially in cases of interruption of supply, when the public telephone lines are immediately blocked by consumers.

Tariffs.—The tariffs for power are:—£2 per annum, or 3s. 4d. per month per H.P. of average maximum demand, and 1d. per unit for the first 4,000 units per month, ¾d. per unit above.—Three-phase A.C.: For the first 5,000 units per month, 1¼d.; all above, ¾d. There are no restrictions as to hours of use.—Private lighting: the charge is 8d. per unit, and 1d. on the Norwich system based on the valuation of the house, and it is hoped in time to extend this system to all classes of lighting supply.

These rates are considered very reasonable out there, where coal averages 20s. per short ton of 2,000 lb., of which 14s. 2d. consists of railage charges over some 800 miles of line, and salaries and wages are higher than at home. With power and heating supply available at 1d. per unit, the demand has rapidly increased, and there is a big future for electric cooking and heating when apparatus is available. With an output for the year ending December 31st, 1917, of 2,854,907 units sold, the total cost per unit, exclusive of capital charges, amounted to 1·54d., which it is hoped materially to reduce now that the new plant is in full service, and with an anticipated output in the neighbourhood of five million units. Several large factories are contemplating changing over from steam to electric drive, but have been held up owing to the difficulty of obtaining plant. It should be noted that the tramways are in the hands of a private company which has its own generating station, consequently the undertaking has not the advantage of a tramway supply as in most other large towns in South Africa.

The London agents for the Municipality are Messrs. Davis & Soper, whilst Messrs. Preece, Cardew, Snell and Rider are the present consulting engineers.

This article would not be complete without some mention of the war. In South Africa there is as yet no compulsory military service, but, on the other hand, there are no indispensables. Every man of the department, from the chief engineer downwards, who is of military age has volunteered for active service, and all fit men to the number of 10 are now away on active service, one of whom has been killed. The rest are all badged as unfit for military service, and are carrying on to the best of their ability.

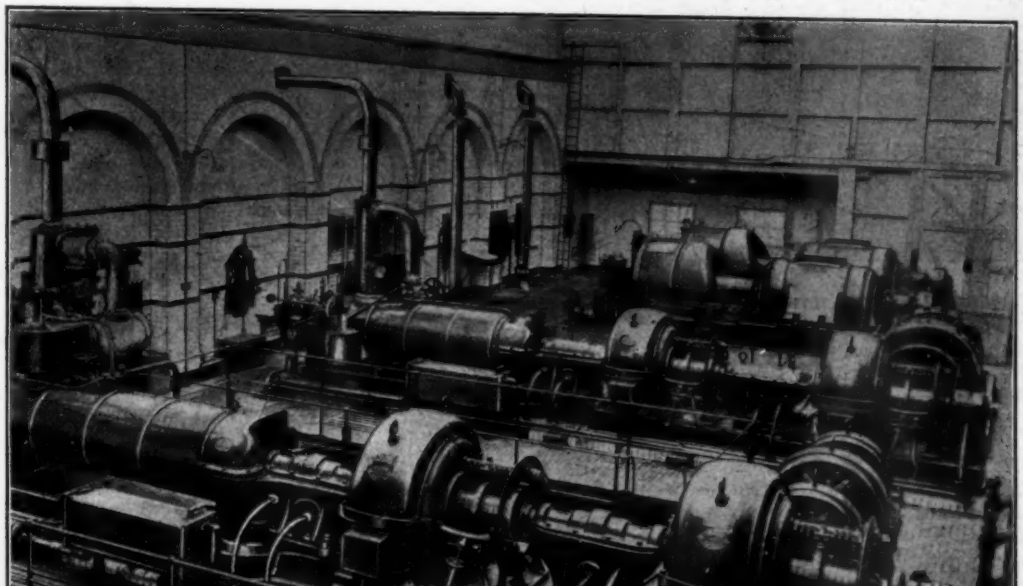

Fig. 3.—Engine Room; Two Original D.C. Sets in Foreground, Two New Turbo-Alternators Beyond, and 500-kw. Motor Converter to the Right.

Concrete Tests.—As the result of experiments carried out in the Structural Materials Research Laboratory of the Lewis Institute, Chicago, it is stated that the ratio of water to cement is found to have a more important effect on the strength of concrete than the quantity of cement or the grading of aggregates. This is brought out by a series of compression tests of about sixteen hundred 6 × 12 in. concrete cylinders. The mixtures used covered a wide range, as also did the grading of aggregate and consistency. The importance of any method of mixing, handling, placing, and finishing concrete which will enable the work to be done with a minimum of water, is at once apparent. It now seems that practically all faulty concrete work can be traced to the use of too much water.—*Engineering News Record*, May 2nd, 1918.

SOME NOTES ON PUBLIC FIRE-ALARM SYSTEMS.

By G. W. STUBBINGS.

The importance of public fire-alarm systems, and the urgent need of simplicity and reliability in their general design and lay-out, are too obvious to receive more than passing mention. Several systems have from time to time been proposed and have been in use, many combining a number of ingenious devices and apparent conveniences, such conveniences, however, only being obtained at the expense of simplicity. Although there are still a number of systems in use throughout the country, modern opinion seems to favour the utmost simplicity that can be obtained. Modern fire-alarm apparatus is characterised by excellence of workmanship, and a high standard is usually attained in the constructional work. The maintenance of such a system is, therefore, largely a matter of methodical routine, and is frequently carried out by a man who has had considerable experience in the telephone service. The average all-round electrical engineer has usually very little to do with public fire-alarm systems, and a few notes describing the principal features of such systems may not be out of place.

The mode of action of the usual system may first be described. To call the fire brigade a handle in the head of the street post is pulled. This rings a bell in the watch room of the fire station, drops an indicator flap showing the point from which the call has come, and also rings a small bell in the head of the street post, to indicate to the person giving the alarm that his call has been registered. The ringing of the two bells is continued till the fireman on duty presses a button or operates a switch. In the head of the post is also a socket, into which a hand telephone set can be plugged, thus enabling the brigade, whilst out, to be in telephonic communication with headquarters. In order that the fire station may be called without giving the alarm signal, there is in the street instrument a small push, frequently in a more or less concealed position, by which the bell at the fire station can be rung without the continuous action of the alarm handle, thus enabling any prearranged system of calling to be used.

The technical details of the system may now be touched upon. The instruments are connected up on the central battery system, an earth return being frequently used. Battery power is now nearly always obtained from accumulators, the voltage of the ringing battery being of the order 30, and the speaking voltage being correspondingly lower. Normally the high voltage is on the line, and the act of pulling the alarm handle puts the bell at the fire station and the bell in the post in series through the line to earth, and also operates a relay coil which keeps the circuit closed. When the small push is used this coil is cut out of circuit, and the ringing of the bells corresponds with the movement of the push. The switch at the fire station for stopping the alarm bell cuts the voltage off the line, and the relay coil in the post becomes de-energised. To receive a telephone call, the telephone at the fire station is plugged into an ordinary jack. Earths on the line can be differentiated from calls by the fact that the ringing of the alarm bell cannot be permanently stopped by the switch in such cases. If an earth should develop the line is disconnected, and the fire-alarm point booked "out of order." This method of differentiating between calls and earths, although seemingly efficient and reliable, is not found satisfactory in practice, as usually the person giving the call, when he hears the bell in the post stop ringing, imagines that his call is being ignored, and immediately pulls the alarm handle again, thereby producing the earth indication. This so frequently happens that fire brigades will usually turn out for a continuous call, it being considered better to risk a false alarm than to incur the possibility of passing over a genuine one.

It is customary for all lines to be tested frequently, usually daily, owing to the urgent need that a faulty alarm be immediately marked out of order. This being the case, the system in which the continuity of the line can be tested at the fire station becomes of doubtful utility. The method used in this system is to connect a condenser in each street post, and to ring a bell through the condenser by a magneto at the fire station, such magneto being plugged into each line in turn. Were it not for the possibility of instrument faults, this would be a great advantage, but as the frequent test from the post is considered essential, the extra complication and expense is hardly justified.

Little need be said regarding constructional work in fire-alarm systems, as such work follows the lines of standard telephone practice. The importance of keeping written information enabling each line to be identified may, however, be mentioned. Each line should have a number, and all cable leads at distribution poles should be labelled with their appropriate numbers. Information regarding open wires on pole lines should be also at hand. In this connection it may be mentioned that the standard method of counting the wires is to begin from the top left-hand insulator, facing away from the distribution pole, taking each arm in turn. Great care should be given to the connection between the open wire and the instrument. Underground leads should be avoided if possible, and fire-alarm posts planted near tramway poles or arc-lamp columns, to which the open wire is attached, and to which the fire-alarm post is connected by a short length of barrel. Failing this, it is advisable to plant a small pole near the post, to avoid the necessity of running a lead underground. Attention to this point will not only lessen the possibility of faults, but will also render the renewal of the insulated lead an easy and inexpensive matter. Where an earth return is used, the earth connection must be made with care. A water service pipe, to which the earth wire should preferably be soldered, makes the best job; but failing this, a length of barrel should be driven down into the ground as far as possible, the earth wire being attached by means of a set screw. The earth wire should be stout, and if it runs any distance from the post, might well be covered by a warning board to prevent its being damaged or severed during subsequent excavations by other people.

Faults on fire-alarm systems can be classed under three heads: Open circuits, earths, and instrument faults. An open circuit, usually known as a "dis," is, as a rule, due to a broken cable lead on a pole, or to a wire being down. As the line is alive up to the break, such faults are easily tested for by an ordinary detector. After thunderstorms, it is always advisable to inspect the protective devices at the fire station. This is usually done by earthing the fuse terminal connected to the line, when the alarm bell will ring if the fuse and heat coil be intact.

Earths are due usually either to broken wires or to faulty underground leads. Such faults are usually localised by sectioning the line at convenient points and testing each section with a detector and battery. For such faults it is most important to be able to identify the required line, in order that the insulated leads at distribution or cross-arm poles may be cut without delay. A very convenient battery for such testing can be made from three ordinary flash-lamp batteries. These can be put up in a very small box, and if the box be provided with a pair of terminals, the battery will be found very convenient and portable; as it is used but seldom, and then required to furnish but a small current, the cells will last a long time.

Instrument faults can usually be located with little difficulty, owing to the simplicity of the apparatus. To those who are unaccustomed to these instruments, adjustments to bells are likely to give some trouble. Being designed to work in series with the alarm bell at the fire station, the usual construction has to be somewhat modified. When the magnet coils of the bell are energised, the vibrating contact is made, and not broken, as in the case of an ordinary bell; this contact short-circuits the magnet coils, and consequently de-energises them, when the contact is broken. When the instrument is disconnected the contacts should therefore be separated.

A fault that is sometimes met with is a feeble ringing of the alarm bell whilst the speaking is satisfactory. This is, of course, due to a high resistance in the circuit, and in such a case the trouble will almost always be found due to a faulty earth connection or to a defective earth. It is better then to renew the earth connection, or, should this be good, to seek a fresh earth. The current required to ring the alarm bell at the fire station is considerable, and, if satis-

factory service is required, it is essential both that an efficient earth be found, and also that the earth connection be securely made.

Two batteries of accumulators are usually installed, one of large cells for normal use, and another of smaller cells as a stand-by whilst the large cells are being charged. These batteries are rather liable to be neglected, or, at all events, not to receive the methodical care required to keep them in good condition. It may, however, be remarked that since motor-driven fire appliances have come into such general use, this state of affairs has largely improved, as there are now usually in the brigade one or two men at least who have the necessary technical knowledge to attend to the cells, and also to realise the need of the care that has to be taken of them.

THE NATIONAL PHYSICAL LABORATORY.

The report of the Laboratory for 1917-18 has just been issued; it is now published by H.M. Stationery Office, in consequence of the transfer of the Institution to the Department for Scientific and Industrial Research.

The present report contains an outline of the history of the Laboratory from its inauguration in 1902. During the war heavy demands have been made upon its resources, and new buildings have been erected for the testing of gauges; further extensions in this connection are now in progress, and the accommodation for aeronautical research is also being extended. The staff has increased from 187 in July, 1914, to 532 at present, in addition to 25 Superintendents and Senior Assistants. While the Committee of the Privy Council for Scientific and Industrial Research has assumed responsibility for the finance of the Laboratory, the control of its scientific work and researches will remain in the hands of the Royal Society. In future, each year a report will have to be submitted to the Research Department in December. The site of the Laboratory has been extended by the purchase of additional land and buildings. One of the new buildings under construction will be devoted to the testing of glass volumetric apparatus, which was formerly procured from Germany. The foundry in the Metallurgical Department has been doubled in size to provide space for the increased work on light alloys, and for the optical glass research. Several other departments are in need of increased accommodation.

Hitherto the primary electrical standards have been in the custody of the Board of Trade, whose Laboratory has been in close co-operation with the N.P.L. The new position of the latter has made it possible to transfer to it the functions of the Board of Trade Laboratory, and arrangements are in progress with a view to this being done.

Amongst other researches which are being carried on are experiments for the Engineering Standards Committee on the efficiency of electric heaters and hot plates, the heating of the sockets of Goliath lampholders, and (for the Institution of Electrical Engineers) the heating of buried cables and the corrosion of lead-covered conductors.

The magnetic disturbances at the laboratory which have occurred since the electrification of the London and South-Western Railway have been referred by the Office of Works to arbitration, and the award of the arbitrator is to the effect that the disturbances exceed in magnitude the limits laid down in the Act under which the electrification was carried out. Further steps are under consideration with a view to giving effect to the award.

The services of the director and members of the staff on numerous Committees, in addition to their work in the laboratory, have been in great demand and have been recognised by the grant of the O.B.E. to Dr. J. A. Harker and Messrs. G. S. Baker, C. C. Paterson, and F. E. Smith; the M.B.E. has been awarded to Messrs. S. W. Attwell, B. P. Dudding, and R. Wolfenden. Mr. F. E. Smith has been elected to the Fellowship of the Royal Society. There are now 49 members of the staff on active service.

The Electrical Standards Division has been almost entirely occupied with confidential work. Much attention has been given to investigations of magnet-steel and methods of testing magnets. A standard inductometer, with a range to 1 MH., has been constructed to supplement the larger one, ranging to 10 MH., which is in constant use. In the Electrotechnics Division, researches have been in progress on insulating materials, magnetos, searchlight carbons, &c. The Heat Division has carried on high-temperature test work, especially in respect of the testing of optical and total-radiation pyrometers, work "of the highest importance in connection with the industries."

Tests made during the year ending March 31st, 1918, attained to the following numbers:—Electrical measurements, 272; electrotechnical apparatus, 7,408; photometry (mainly luminous dials), 16,993; radium preparations, 81; pyrometry, 213. The total for the Physics Department was 233,869.

The income of the Laboratory from January 1st, 1900, to March 30th, 1914, was £282,545, of which £166,633 was payments for work done; expenditure amounted to £283,041. The income for the year was £103,979, an increase of nearly 50 per cent. over 1917 gauge testing for the Ministry of Munitions accounted for £36,610. The expenditure was £100,785, and the credit balance £3,194. Salaries amounted to £78,282.

The report of the *Electricity Division*, Section A, of the Physics Department (Mr. F. E. Smith and Mr. Napier) states that most of the time of the Division has been occupied with work of a confidential nature, partly wireless telegraphy. The Laboratory standards of E.M.F. have been compared with those of Japan through the intermediary of some Weston cells brought to Teddington by Dr. Yokoyama; there was a mean difference of four parts in a million, a very gratifying result. Magnetograph records have shown coincidences between the running of electric trains on the L. & S.W. Railway system and magnetic disturbances at the Laboratory, and incidentally have demonstrated the excellent aperiodic qualities of the magnetograph. In Section B (Mr. Campbell and Mr. Dye), a standard mutual inductometer for a maximum of 1 millihenry has been constructed; on the lowest range the whole scale will be equal to the microhenry, extended to 100 times this amount by dial coils. Means of accurately testing precision search coils with the aid of the magnetic fields of solenoids were investigated, and an accuracy within one part in 1,000 was found to be attainable. Various tests were carried out in connection with magneto condensers, compass magnets, search coils for horse-shoe magnets, &c.

The *Electrotechnics Division*, Section A (Messrs. Paterson, Kinnes, Walsh, and Dr. N. Campbell), has also been engaged on confidential work. Mr. Paterson is serving on the Electrical Research Committee and several Sub-Committees of the Engineering Standards Committee, and is chairman of the Sub-Committee on electrical parts of aircraft. Insulating materials for magnetos have been under investigation, as well as the heating of Goliath lamp sockets, luminous compounds, gun sights, &c., and work in connection with the Paterson-Walsh height-finder has occupied a good deal of time. In Section B (Messrs. Melsom and H. C. Booth and Miss Cockburn) Admiralty work has been dealt with, and the buried-cable research has made good progress. It has been found that the rise of temperature of a cable drawn into a stoneware duct is twice that of a similar cable armoured and laid direct in the ground; cables laid solid in bitumen occupy an intermediate position. A special motor-generator has been designed for this work and for the heavy test work of the Laboratory; it consists of two D.C. generators, each fitted with two commutators. Each commutator is arranged for a current of 1,250 A. at 6 V., and the commutators can be put in series or parallel as required. The set is driven by a three-phase 3,000-volt motor, and excitation is provided by a separate motor-generator set with automatic speed control.

In the *Heat Division*, Section A (Dr. Griffiths and Mr. Schofield), the use of tungsten arc lamps as a comparison source for calibrating optical pyrometers has been extended with advantage, and the Edison Swan Co. has constructed special lamps covering a range of apparent temperatures from 900 to 2,700° C. Much work has been carried on in connection with high-temperature scales, and the direct calibration of optical pyrometers against the melting points of palladium and platinum. It has been found possible to standardise total radiation pyrometers against the melting points of gold and palladium wires, and it is hoped to extend the method to platinum. A considerable amount of work has been done on the efficiency of electrical hot-plates and cooking stoves.

In the department of Metallurgy (Dr. Rosenhain) the foundry has been extended, with gas and electric furnaces. An electric furnace provided for high-temperature thermal curve observations has made it possible to take thermal curves up to the highest temperatures that thermocouples can withstand, with the same ease and accuracy as at moderate temperatures; in this furnace the hottest portion is at the top, and the specimen is pushed up from below, so that the supports and the wires of the thermocouple do not pass through the hottest region.

Colour of Transformer Cases as affecting Capacity.—Mr. H. M. Daman, in the *Electrical Review*, N.Y., considers that, with the larger capacities coming into vogue and the greater use of out-door installations, because of their lower unit cost and simplicity, the choice of colour of transformer casings, metering houses, &c., might to good advantage be given more consideration than it apparently receives.

Theoretically, the output of a transformer, as governed by internal temperature, should be influenced by the colour with which the external surface of the case is painted. A black body more readily radiates heat from within than does a light body. But it also absorbs heat more readily than a body of light colour. It seems that under certain circumstances it might be preferable to employ a light coloured paint rather than a dark one, depending upon the climatic conditions and the load, whether occurring during the night or the day.

In intensely hot climates, with transformers exposed to the sun's rays for long periods daily, the author has encountered a number of transformer burn-outs from no apparent cause, that later were found to be due to the continuous maintenance of excessive temperatures, although the load was by no means continuous or constant. The explanation advanced was that the heat absorbed by the black cases was responsible for the high temperature.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Lighting and Power Sets for Farm Use.

One of the features of the electrical business in the United States at the present time is the large amount of attention which is being devoted to the production and sale of compact plants for electric lighting and power purposes on farms. Among the concerns which have entered this branch of trade is the Edison Storage Battery Co., of Orange, N.J., which, however, is only supplying the dynamo, battery, and switchboard, leaving the purchasers to use an existing oil, gas, or petrol engine, or to purchase one suitable for the electric plant and to their own local requirements.

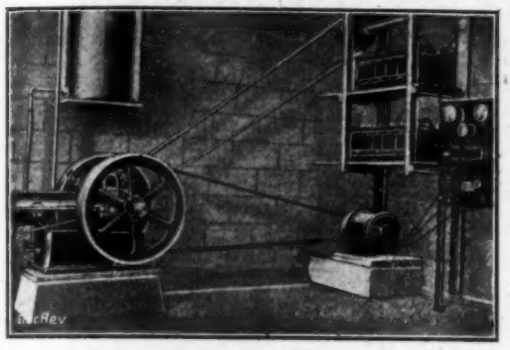

Fig. 1.—Edison Electric Set for Farm Use.

The Edison Co. is supplying the sets mentioned in two-voltage capacities—30 and 110-volts—the 30-volt outfits being furnished in four sizes and the 110-volt sets in five sizes. The generators supplied with the sets are of standard design, and call for no special description. The batteries are of the Edison alkaline pattern in solid steel containers, giving 1·2 volts per cell. They are similar to the Edison batteries used for other purposes, except that they have a high amperage rating, and have additional space above the plates, so that they only require refilling with liquid at infrequent intervals. The switchboards are mounted on slate panels, and are equipped with a charging rheostat to control the current from the generator, an underload cut-out to prevent the battery discharging through the generator should the engine stop, a switch, and ammeters. The wiring to the switch is so arranged that lamps can be run from the generator alone, from the generator while the battery is being charged, or from the battery alone.

Accumulator Repairing Appliances.

There is a steadily advancing call on electrical engineers and motor repairing firms for repairs to batteries. A concern which is specialising on useful appliances for this work is the American Bureau of Engineering, of 1018, South Wabash Avenue, Chicago, U.S.A., whose steaming arrangement for softening the sealing

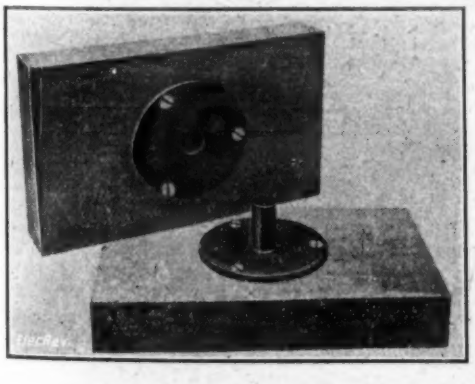

Fig. 2.—Battery Turntable.

compound used on starting and lighting batteries, to enable them to be readily opened out, was illustrated in a recent issue of the Review.

In addition to this device, the company named has also lately introduced the handy battery repair shop appliance shown in fig. 2; as will be seen, it takes the form of a bench turntable to facilitate the work of the repairer. It consists simply of a couple of pieces of well-seasoned hard wood, 10 in. long, 6 in. wide, and 2 in. thick, a hole being drilled centrally in one, and provided with a cast-iron disk, the other being fitted with a pivot, also of cast-iron; the two blocks thus fit over each other, enabling the battery to be moved about with no more force than that exerted by the finger. The turntable is not secured to the bench, the weight of the battery being sufficient to hold it in position.

Another battery repair appliance made by the same concern is the plate press (fig. 3), intended for use in pressing battery plates when dismantled for cleaning and repair.

Many battery repairers press plates in an ordinary bench vice; this is, however, hard on the vice, as acid drops from the plates on to the iron parts, which in time become badly corroded and rusted. The plate press illustrated has been specially designed for the work, and is so constructed that there is no metallic part which can be reached by acid dripping from the plates. A trough is so

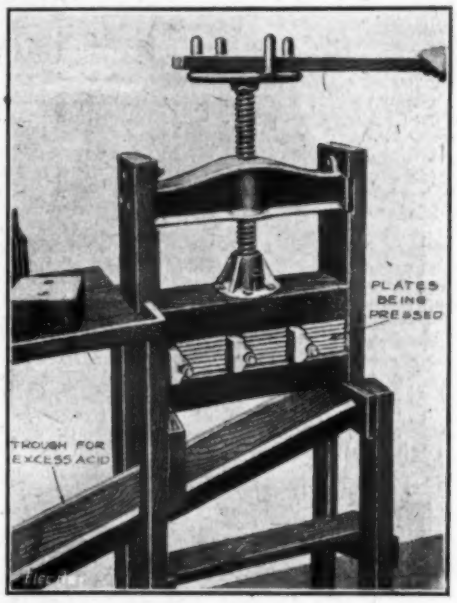

Fig. 3.—Battery Plate Press.

arranged that the acid which is squeezed out of the plates is carried off into a drain, and there is consequently no rotting of the floor beneath the press, and no wet, acid-covered floor to ruin shoes and clothing. In pressing plates, "transite" boards of the proper thickness are placed in each space between successive plates, with two boards on the outside of the end plates. The group of plates is then put under pressure, either to straighten the plates or to force the active material into the grids flush with the surface of the latter. Three groups of plates may be pressed at one time in the press, this resulting in a considerable saving of time. The press measures 2 ft. 4 in. in height, and 2 ft. 2 in. in width, and is provided with a 14-in. handwheel, and is supplied with twenty-one

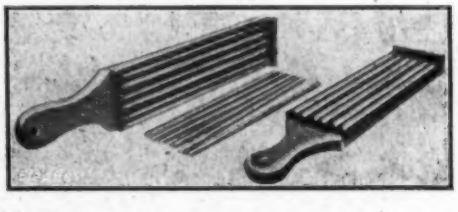

Fig. 4.—"Ambu" Burning-lead Mould.

$\frac{1}{4}$-in. and twelve-$\frac{1}{16}$ in. transite boards. Finally, reference may be made to the "Ambu" burning-lead mould (fig. 4). In every battery repair shop there is an accumulation of scrap lead from post drillings, old connecting straps, plate straps, and plates; these should be kept in a special box provided for the purpose, and when a sufficient amount has accumulated, the lead should be melted and run off into moulds for making burning-lead. The mould illustrated, which has been introduced for this purpose, consists of a sheet-iron "form" pressed into six troughs or grooves into which the melted lead is poured, and is conveniently mounted on a block of wood with handle, making it possible to handle the mould while hot without danger of the user being burned. A sheet of asbestos separates the iron from the wood, thus protecting the wood from the heat of the melted metal. The grooves in the form will produce bars of burning-lead 15 in. long, $\frac{1}{16}$ in. thick, $\frac{3}{4}$ in. wide at the top, and $\frac{1}{2}$ in. wide at the bottom.

BOILER AND OTHER REPAIRS BY ELECTRIC WELDING.

By R. S. KENNEDY.

(Abstract of paper read before the Institute of Marine Engineers.)

The tests of electric welded specimens carried out to the instructions of Mr. Boyle and Mr. Carleton in 1909 and 1910 were of great value in connection with the Board of Trade. These tests were made not only with the object of getting at the tensile strength of the weld, but of finding out if the process of welding affected the neighbouring material. Numbers of specimens were tested, and some of these were annealed, but it was found that annealing made no difference to the results, and the material immediately adjacent to the weld behaved in a normal manner. These tests gave a tensile strength of about 17 to 18 tons per square inch, but since then improvements in the materials and methods have increased the tensile strength of welds in boiler steel to about 27 tons per square inch. In practice, however, the writer would not recommend that a tensile strength of more than 20 tons per square inch be worked to, this giving a sufficient margin for possible small defects in workmanship. In no single case has the writer known an electric weld to give way suddenly; failure has always been preceded by a small crack, which has gradually developed.

Electric arc welding is primarily a form of autogenous welding. It is, however, found in practice that the application of even the moderate amount of pressure produced by a hand hammer increases the tensile strength and tenacity of the weld from 5 to 10 per cent. It is essential that this work should be put into the material when it is at welding heat or, at any rate, above the black heat. The iron wire used is of the very best material, with preferably a small percentage of manganese. This iron wire has been very heavily worked in the process of manufacture, and subsequently annealed, and as used by the writer's firm shows a tensile strength of 28 tons with an elongation of 50 per cent. Somewhat similar results are obtained in another field with cast iron, which has several times been remelted.

In electric arc welding with a metallic electrode one great advantage is that, with the exception of the atmosphere, there are no impurities to guard against, except such as are introduced in the materials. The source of heat is pure, and we have to see that the job is properly cleaned and the metallic electrode of suitable material. Still, to provide against oxidisation and also to increase the fluidity of the metal a flux is necessary for good work in arc welding, and the heated metal is protected from oxidisation by an inert gas given off by the flux. The most convenient method of applying the flux is to coat evenly the metallic electrode, thus providing a constant and uniform supply.

It is quite a common practice to weld over a riveted seam; rivets in the area dealt with should be completely welded over, and not left half covered. After welding a seam it is necessary to caulk the landing edge for some 6 in. at each end of the welded portion. Work can be carried out directly overhead, or in any position that is accessible to the welding pencil, and where the operator can see what he is doing. As the work requires constant attention on the part of the operator, it is advisable, in order to get the best job, to make it as accessible as possible, and that the operator should be reasonably comfortable. In common with hand welding, a good job depends on the conscientious work of the man. The writer's firm has always trained its own welders, and keeps them in constant employment. A full report is made of each job, and the name of the welder recorded; the whole object of the training is to inculcate a sense of responsibility.

The materials at present dealt with on a commercial scale are wrought iron, steel, and cast steel, and occasionally cast iron. The range of temperature of the welding heat is the determining factor in the adaptability of a substance for welding. Much successful work has been done with cast iron, notably with castings of considerable age, which have not been subjected to corrosive action, and with the good mixtures of more modern times. It is probable that there is a welding temperature of cast iron, but the range of this temperature is very small, something of the order of 10 deg.

The voltage across the metallic arc is about 22 to 25, and the writer adds an equal steadying resistance, which makes the voltage at the terminals of the dynamo about 45. A substitutional resistance is employed which is put in circuit by an automatic switch, when the welder breaks his arc, thus keeping the load on the machine constant. The amperage actually employed is about 175, but in practice a 200-ampere machine is necessary, while the writer's firm uses machines designed for 250 amperes. In the big passenger liners it is the practice to weld from the ship's dynamo, suitable welding and substitutional resistances being provided.

The preparation of a job for electric welding is a matter of considerable importance, as the presence of impurities is likely to be detrimental to the weld. In dealing with the external or fire surfaces of a boiler it is usually sufficient to use an ordinary chipping hammer, and then thoroughly wire-brush the metal to be dealt with; but some superintending engineers prefer to have a light chipping taken over the surface, which is, of course, the ideal preparation. When it comes to dealing with the water surfaces of a boiler greater care is necessary, especially if zinc plates have been freely used. The welder, if a properly trained man, would at once recognise this difficulty and apply the only remedy, which is to chip down till pure metal is reached.

Arc welding being a building-up process, cracks are dealt with by veeing out at the line of fracture, the vee being made wide enough to ensure that the welder can reach with his pencil to the bottom on either side with a certainty of striking his arc at any required position. As the welder is a highly skilled man, it is usual for the boilermakers to prepare the work to instructions, and the welder himself puts in the finishing touches. The welding-in of new backs to combustion chambers or tube plates, or work of that kind, is dealt with in a precisely similar manner, although here certain allowances have to be made for the work drawing together as the welder proceeds. It should be mentioned that in dealing with cracks it is absolutely essential that the whole of the fractured portion be cut away, and a very good guide is to cut away till a solid chipping is obtained, and then go a bit deeper to be on the safe side. If welding is carried out over a partially cut-away fracture it is certain that sooner or later it will work to the surface. One of the most unsatisfactory matters we have to deal with is the welding of a crack in the original weld of a furnace, as it is most difficult to say where the defective weld ends, and a further defective portion some short distance along may work back into the part dealt with.

The writer recalls an incident when we were called in to weld a crack, apparently about one inch long, in the back of a combustion chamber of a Swedish vessel. Our man started to cut out the crack when with a loud report the chamber back split right across, showing a fracture a full sixteenth open. This caused great alarm at first, and we were charged with using undue vigour, but on veeing out the fracture for welding it was found that the back was grooved right across on the water side, so we were exonerated. Owing to its higher temperature the electric arc is more suitable for dealing with the heavier sections than oxy-acetylene or oxy-coal gas; on the other hand, for thicknesses of 3/16 in. and under, one of other of the gas systems is preferable.

The writer claims that arc welding, where carried out by skilled operators with suitable materials, is absolutely reliable, and can point to some 20,000 jobs, some of a very big nature, while the percentage of even partial failures would, at any rate, be on the right side of the decimal point. These partial failures would be mainly accounted for where the work was carried out under unfavourable conditions, and often in the nature of a forlorn hope. Great difficulties are met with in hurried repairs to the lower portions of the hulls of vessels in dry dock, where water is constantly dripping from the leaky portion, and owing to the cement inside it is often impossible to stop it in the time available.

The question of the resistance of welds to rapidly alternating stresses and shocks is somewhat obscure. Some year or two ago the writer's firm was asked to weld the broken piston rod of a 10-cwt. steam hammer, which had already been twice welded in the fire. This was carried out, and it is now running satisfactorily.

CORRESPONDENCE.

Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Trade Unions: Past, Present, and Future.

Having stated, in no uncertain terms, that the principles of trade unionism must undergo a great change, it is to be expected that the writer should be prepared to indicate some general outlines at least on which such reforms should be based, and he takes this opportunity of suggesting some ideas, which might well form the foundation for the development of the new trade unions, or, better still, the reconstruction of the old, particularly those relating to the electrical industry, hoping that among the existing unions many men will be found to give thorough consideration to the proposals, with the object, not of destroying, but of co-ordinating all present effort, and producing a form of trade unionism worthy of the name.

Into what he will call the Electrical Trade Union the writer would admit everyone engaged in the electrical industry, with the possible exception of tramway workers, who would have their own union, and he would divide it into four sections—Grade 1 (skilled men), Grade 2 (semi-skilled), Grade 3 (unskilled), and Juniors (lads under, say, 18 years of age, whether serving a recognised apprenticeship or not).

On reaching the age of 18, if that were the appointed age, the lad should pass automatically into either Grade 2 or Grade 3, according to his ability and qualifications, but on no account would he be admitted immediately into Grade 1. Yet, no matter which grade he was placed in, he should be given the opportunity of showing his value, and of being

elected later into the higher grade. In fact, it should be instilled into every man that his union looks to him to qualify himself for a better grade, and it must be made worth his while to exert himself in this direction.

This can best be done by a reasonable control of wages, and it should not be possible for a junior to earn as much for an ordinary working week as an unskilled man even, while the maximum for unskilled labour should be below the minimum for semi-skilled, and the maximum for semi-skilled below the minimum for skilled labour. Thus will there be every inducement for intelligent and steady men to make themselves skilled men.

But, as Mr. J. S. Hecht points out in his excellent remarks on the problem of reconstruction in the [illegible]'s Electrical Review, "if a skilled man does not produce greater value per hour than an unskilled, what would be the use of skill?" The trade union must see that only those who are really efficient workmen, in the sense that they produce in a fair proportion, are elected to Grade 1, and they must also have, and use, the power to relegate a man who, having reached a higher grade, thinks he can relax his efforts and generally have a slack time.

The habitual bad timekeeper must be dismissed the union, after a fair trial before a jury of his fellow-members. If dissatisfied with their verdict he should have the right of appeal to a central tribunal consisting of representatives of all trade unions.

For the promotion of "real uplifting qualities and education," as mentioned by Mr. J. A. Tasker, special committees should be set up, but in the case of the Electrical Union these committees should be constituted of electrical men only. In fact, it would be a good thing for trade unionism if it insisted that the whole management of its affairs should be in the hands of men with actual experience in the particular trade which that union represented.

The special educational committees should promote lectures and demonstrations, and be able to find an instructor for any member on any point connected with his calling. They should encourage invention, and should, moreover, undertake that the ideas of inventors in their union should be thoroughly investigated, and that the members should reap the rewards of their inventions.

For the juniors, a good number of trade union scholarships should be awarded, which should be tenable for at least three years, and which should provide the deserving lad with instruction not only in the workshop, but in the technical schools as well, his time being equally divided between the two.

Many other details will have to be considered, such as the subdivision of Grade 1 into technical and non-technical sections, subscription rates, employers' representation, &c., but these are the general principles on which the unions should be established, and the writer is certain that the adoption of them would lead to more understanding and happier relations between the employer and the employed. If the existing unions will not move of their own accord, then all reasonable men must join hands to make them.

The Writer of the Article.

August 17th, 1918.

Instruments for Central-Station Switchboards.

I have been away owing to severe personal bereavement, and have only just heard of Mr. Jepson's letter on the above matter. I do really think it is a pity that the representatives of the Aron Company should adopt the tone they do; one is reminded of the old adage, "No case, abuse defendant's attorney." I am not going to waste your space with a "paper war" with Mr. Jepson, but as he directly charges me with breach of faith, I am bound to clear myself. The meters I tested were the type normally recommended for heavy switchboard work, and so used as I know in several cities; it therefore seemed very relevant to Mr. Stubbings's article, which, as "A.M.I.E.E." put it, placed Aron first and the rest nowhere, to point out one serious drawback. And to his ingenious attempt to discredit my impartiality I simply say: (1) The idea of using Aron meters for this particular war job (26 meters) originated with me and not with them. In the early days my experience with Aron meters was most unfavourable, but meters are capable of improvement, and in view of the particular requiremepts (to run together closely) I honestly thought, in view of the theory of the meter, they ought to do better than anyone else. Equally honestly I say I am disappointed they do not, and I do not know how I can put it fairer. (2) No tests with the carbon rheostat below the meters were taken into account—but I could not trace any effect to that. All tests considered were in a special temperature chamber. (3) Much as it may disappoint Mr. Jepson, it is a fact that the competing meter has no patent of mine on it, nor is it proposed that it shall. In conclusion, I am quite content to leave it to those who trouble to read this correspondence to judge the merits of the matter.

E. Fawssett.

Buttermere, *August 19th*, 1918.

[We think the prolongation of this regrettable controversy would serve no useful purpose; in closing it, as entirely unbiased (and uninvited) umpires, we may be allowed to sum up the matter as it appears to us. On the one hand, we have every reason to believe that Mr. Fawssett in conducting the tests had no object in view but to obtain the most suitable meters for the particular purpose for which they were required, and that he neither had nor has any but friendly feelings towards the makers of the Aron meter. On the other hand, in view of the reputation and theory of the meter, we do not believe that these particular tests should be interpreted in a general sense as constituting an indictment against the type. It is obvious that two meters of exactly the same pattern and constructed of the same materials ought to run well together under varying temperatures; it is admitted that the makers took this for granted, and did not put the matter to the test before delivering the meters, a precaution which evidently was very necessary. *Hinc illae lachrymae.* In normal times, no doubt, the mishap would not have occurred.—Eds. Elec. Rev.]

Tar Oil as Motor Fuel.

In your account in this week's Electrical Review of Mr. Wilkinson's invention, where you describe how to run a petrol engine on tar oil, you say: "The whole secret of it is a piece of ¼ in. copper pipe taken through the exhaust pipe, which is Mr. Wilkinson's patent." My patent No. 106,379, of which a full account appeared with drawing in the *Autocar* of February 3rd, 1917, appears to cover this, as I show how to run on crude paraffin, and the point in my patent is the fact that I take my hot air inlet, which I describe as a ¼ in. copper pipe, through the exhaust pipe, as you will see by the sketch. I enclose a leaflet which is a reprint of the article in the *Autocar*.

E. O. Walker & Co.

Manchester, *August 14th*, 1918.

[Messrs. Walker's letter arrived too late for inclusion in our last issue. Mr. Walker's invention includes, as stated, an air pipe passing through the exhaust pipe, at right angles to it, together with an arrangement for admitting a small proportion of water in the form of steam to the cylinders with the air. Mr. Wilkinson's hot-air pipe traverses the exhaust pipe longitudinally from end to end.—Eds. Elec. Rev.]

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from page* 156.)

Among the "optical and mechanical instruments" is a display of magnetos and dissociated parts of magnetos shown by the British Ignition Apparatus Association, which provides one of the most attractive features of the exhibition. All the associated makers are represented there, while the well-known B.L.I.C. magneto is shown on the stand of Messrs. Vickers, Ltd., of which the British Lighting & Ignition Co., Ltd., is a subsidiary company. The B.L.I.C. was formerly the well-known Bosch machine, and it is as popular as its predecessor. This and other magnetos are made in various forms, each specially designed for some particular purpose, but they are all variations of one general plan. The magnets are horse-shoe shaped, and in the larger machines the magnet has a second set of steel bars outside the first. On the inside of the horse-shoe two pole-pieces are bored to receive the armature, which consists of an iron core wound over with a coil of insulated copper-wire, either silk covered or enamelled. One of the chief differences between the different magnetos lies in the winding of the armature coil. In the case of low-tension magnetos the armature has about 150 turns of wire wound on it, the wire being about 1/20 in. in diameter. In the case of a high-tension machine, the magneto may have much finer wire and about six thousand turns. Modern high-tension magnetos have two windings, a thick wire followed by a thin wire, the latter having many more turns. High-tension magnetos use the momentum of a low-tension current to reinforce the voltage of a high-tension coil, producing an excellent spark in this way.

It would be an advantage if the British Ignition Apparatus Association, which is responsible for the exhibition of magnetos produced by its members, could arrange for someone to be in attendance at its stand to explain the construction and action of the apparatus used for electric ignition, and to give the public an idea of the meaning of the various machines displayed, for the exhibit is indeed a striking one, and a most promising augury of future trade.

Closely associated with the production of the magneto is the supply of varnished insulating cambrics, silks, and papers. A selected range of samples of these is shown on the stand of the British Ignition Apparatus Association, but only one British producer of these materials is exhibiting, as far as we have been able to ascertain.

This is Messrs. Abbott, Anderson & Abbott, Ltd., London, who show the "Abbott brand" of all-British varnished insulating cambrics and silks which are extensively used for electrical apparatus, including magnetos. The specimens shown are typical of the materials manufactured at the company's works at Harpenden, and indicate how successful the company has been in overcoming the initial difficulties which

beset the production of such insulating materials when their manufacture was first undertaken in this country. Before the war varnished silks, cloths, papers, &c., were produced chiefly in Germany and Austria. Large supplies of these materials have been coming in from America, but the British products are in every way as good as the products formerly obtained from Central Europe and now obtained from the United States.

The British Central Electrical Co., Ltd., London, are showing a number of multiple fuses, watertight fuse boards, insulated hand-lamps, lampholders, adapters, &c. These exhibits are designed to afford protection against accidents from misuse or otherwise of all electrical fuses, hand-lamps, wall plugs, and similar apparatus. The chief feature of the design of these appliances is that all metal parts that could possibly come into contact with the user's hand are covered by a shield or handle specially designed and made of insulating material. All parts forming the case or non-carrying current portions of the apparatus are efficiently earthed, arrangements for earthing having been provided where designs have not permitted the accessories to be fitted with insulating protection.

The Damard Lacquer Co., Ltd., of Birmingham, are exhibiting specimens of "Formite" products showing their application for electrical insulation. In the initial state "Formite" is a fusible, amber-coloured resin, soluble in alcohol, ether, acetone, fusel oil, &c., with a melting point of about 150 deg. F. When heated to 250 deg. F. it changes, by a chemical reaction known as polymerisation, into a hard, homogeneous, amber-like product, which is no longer soluble or fusible at any temperature, exhibits high insulation, and is hard, with good tensile strength. On account of its exceptional properties, "Formite" is an excellent material for electrical and heat insulation.

Messrs. Fleming, Birkby, & Goodall, Ltd., of Liversedge, are also showing special moulded insulation suitable for all kinds of electrical work. Certain grades manufactured by this company will stand temperatures up to 2,000 deg. F., and the dielectric strength is 550 to 600 volts per mil. This firm also specialises in the manufacture and supply of all other kinds of electrical insulating materials, mica and micanite, fibre, presspahn, leatheroid, insulating cloth, silk, tape, &c., and every type and kind of electric traction overhead line fitting for round, grooved, or other section of trolley wire, trolley heads, wheels and bushes, and general electrical accessories.

What is claimed as a substitute for the German product "Stabilit" is "Hightensite," a high tension electrical insulating material, manufactured by "Hightensite," Ltd., London. Before the war the magneto industry in this country was restricted partly by the lack of a satisfactory insulating material suitable for this class of high-tension apparatus. "Hightensite" gives perfect insulation, has a dielectric strength which withstands a pressure of more than 20,000 volts per mm. thickness, is non-hygroscopic and non-inflammable, does not carbonise under sparking, and has a wearing surface equal to that of brass. The latter points are of supreme importance for running-contacts as used in magnetos and rotary engine distributors. Its high insulating and weatherproof properties make it invaluable for wireless apparatus. Metal inserts can be moulded in position, thus allowing greater strength and better finish than in built-up articles. This material is shown by the Park Royal Engineering Works, Ltd., London.

The Igranic Electric Co., Ltd., London, are showing an improved pattern of self-supporting coils for electrical purposes, wound by "Leesona" universal machines. These machines automatically count and stop at any predetermined number of turns, prevent kinking, entangling, or stretching of the wire, and enable one operative to control several machines. The latest form of machine interposes a cross winding of cotton between parallel turns of wire, binding the whole into a self-supporting mass which is easily impregnated, and when finished becomes practically indestructible. Another machine cross-winds the turns of wire, and can make a self-supporting coil as narrow as 3/16 in. and several inches in diameter with practically zero capacity between the layers.

Messrs. Isenthal & Co., Ltd., London, are showing resistances of the sliding contact type which are based on German models, with such improvements as experience has proved to be necessary. They are used in connection with experiments and tests in laboratories, for charging accumulators, regulating small generators, to control the various circuits in wireless work, and as regulators for electric furnaces. Two classes of resistances are made: in one of these the resistance wire is wound on slate supports, and in the other oxidised wire is wound on steel tubing with a vitreous enamel coating, or on mica tubing.

A hand automatic electric welding machine for welding iron and steel wires from 0.05 in. to 0.2 in. diameter, and copper wires from 0.05 in. to 0.175 in. diameter is shown by the Electric Welding Co., Ltd., London. The welder is electrically automatic, and has two clamps, one of which is stationary, while the other is movable towards the fixed clamp by means of an adjustable pressure spring. The clamps are also adjustable for wires of different sizes, and are fitted with renewable steel cheeks. The wires being properly clamped in position, the circuit is closed by an external switch, and the button switch on the top of the welder is pressed. The wires immediately heat and are forced together by the pressure spring, the circuit being opened by an automatic cut-out device, adjustable by means of a quadrant scale and set-screw. In making the weld the metal is upset, leaving a swelling or burr around the weld, the size of which depends upon the tension of the spring, and the setting of the cut-out device.

Messrs. Everett, Edgcumbe & Co., Ltd., Hendon, are exhibiting an interesting range of measuring and testing instruments, including the "Luxometer" portable photometer. Measuring and testing instruments are also shown by Messrs. Evershed & Vignoles, Ltd., Chiswick, including instruments of the moving-coil and moving-iron types. The well-known "Megger," "Bridgemegger," and "Ducter" testing sets are also exhibited.

The exhibit of the National Physical Laboratory is exceedingly interesting. Mention should be made of the Duddell Oscillograph, which was the actual instrument belonging to the late Mr. W. Duddell. The electrical exhibits of the National Physical Laboratory are not quite up to the same standard as those dealing with other sections of the Laboratory's activities, but on the whole they are worth inspecting as showing what the institution at Teddington is capable of.

The difficulty of obtaining electrodes for use in electric furnaces serves to give prominence to the exhibit of the Alby United Carbide Factories, Ltd., of Hebburn-on-Tyne, who are showing amorphous carbon electrodes from 12 in. to 20 in. in diameter by 6 ft. 6 in. long, with screwed recesses for jointing and avoiding the loss of stub ends. These are used in electric furnaces for the manufacture of electric steel and ferro-alloys.

The exhibit of Messrs. Duram, Ltd., is especially noteworthy. It occupies very little space, but presents a range of tungsten products which indicate sufficiently the scope for the industry in this country. Specimens of finely drawn tungsten wire and tungsten contacts are shown together with other finished and partly finished products of tungsten and molybdenum. The Edison Swan Electric Co., Ltd., of Ponders End, are also showing exhibits of tungsten and molybdenum, from the ore to the finished article, which include targets for "Pointolite" lamps and wire for electrodes.

A preparation manufactured by Mr. H. E. Davis, London, is shown for obscuring electric lamps and other glass. It does away with sand-blasting or treatment with acids. It is claimed that by placing lamps in a solution for twenty or thirty seconds and afterwards wiping them with a damp sponge, a frosting equal to sand-blasting can be obtained.

(*To be continued.*)

WAR ITEMS.

German Hopes of "Restoration" Orders.—The "Times" states that great efforts are now being made in Germany to revive interest in the economic plans of "Central Europe," and a great deal of advertisement is coming from a new "German Economic Council for Central Europe." The list of founders contains all the usual names—Ballin, Merton, Lanz, Bosch, &c. The programme, however, is interesting, because it is rather more definite than usual about the commercial penetration of subjugated countries. For example, it says:—

> The establishment of the new-formed States in the west and south of Russia, and the restoration of the territories devastated by war, will provide a mass of public orders in which German industry must be interested. German participation ought to be secured by treaty, so that America and the other Entente States shall not be able to compete, with the advantage of their cheaper raw materials or cheaper tonnage.

In other words, Germany proposes that the Eastern States and municipalities shall be forced to buy her goods at artificial prices, instead of buying in the cheapest market. It is argued that in this way Germany will be able to supply the Polish towns with drainage and with gas or electric lighting; and it is pointed out that conditions in the Ukraine, the Baltic Provinces, and Lithuania are still more primitive. Having laid these countries waste, the German building industry is to enjoy the monopoly in restoring them.

Trade Disputes in War Time.—The following are the terms of a new regulation which has been made under the Defence of the Realm Act:—

> "Where a difference has been referred under sub-section (2) of Section 1 of the Munitions of War Act, 1915, for settlement in accordance with the provisions of the First Schedule to that Act, and it appears to the Minister of Labour that an award cannot be obtained, and that, in consequence thereof, the production of any article essential to the successful prosecution of the war is hampered, the Minister may annul the reference and substitute therefor a reference to a single arbitrator appointed by himself. An award given by any such arbitrator shall be binding both on employers and employed, and may be made retrospective. If any employer or person employed thereafter acts in contravention of or fails to comply with the award, or if an employer declares, causes, or takes part in a lock-out within the meaning of the said Act, or a person employed takes part in a strike within the meaning of the said Act, in connection with the difference so referred to a single arbitrator, he shall be guilty of a summary offence against these regulations, but a person guilty of any such offence shall not be sentenced to imprisonment."

An Appreciation from France.—A correspondent writes:—"I write to express my sincere gratitude for the continued receipt of the Electrical Review. My service in France will soon have totalled four years, and although I have been constantly employed on one branch of electrical engineering—telegraphy and telephony—other branches are of greater interest to me, and therefore the receipt of your journal, week by week, has prevented absolute staleness, and kept me in touch with the general progress of the industry. My case, I feel sure, is by no means an isolated one, and many others must have realised with me how adequately your journal has proved a substitute for further study and recapitulation, which have been impossible in the circumstances, and yet so essential to the young engineer just at the end of his training. Personally, I read it twice, finding in a superficial glance, when time presses, the pleasure of fiction; and in a close study, which leisure affords, the instruction of a text book."

Exports to China.—The "London Gazette" for August 20th contains additions to, and amendments in, the list of persons and bodies in China to whom exports may be consigned.

Exemption of men of the new Military Age.—The Ministry of National Service announces that instructions have been given that men of the new military age who come within the terms of the List of Certified Occupations, R. 136, are not for the present to be called up for medical examination, the necessary consequence of which is that they are not called for military service, and need not make any application to tribunals. The list of certified occupations is now being revised, but it is proposed that, in general, the same provision should also extend to men of the new military age who are within the terms of the revised list. The object of this provision is to enable the older men who are engaged in a certified occupation to continue in that occupation, and in these cases it is therefore unnecessary and undesirable for men to change their occupation. Every care is taken that such men shall not be sent medical examination notices, but owing to the doubt as to the precise occupations of many men as shown in the National Register, some notices may be issued to men who should not receive them. In these cases it is arranged that the notice will be cancelled provided the man returns it at once to the office of issue, and establishes his claim to be of the new military age and to be engaged in a certified occupation.

Exemption Applications.—At Exmouth, E. H. Gudgeon (grade 2), electrical engineer, stated in his appeal that he was engaged at times on work of national importance in electrical work at the Red Cross Hospital. He was exempted until the end of the year.

An electrical engineer (39, grade 2), who appealed at Swinton and Pendlebury, was granted three months' temporary exemption.

At Reading, on August 12th, an appeal was made by A. Herbert, (45, grade 2), electrical engineer. He was granted three months, with leave to appeal again.

On a review, conditional exemption held by T. D. Webb, electrician at Herts County Asylum, has been cancelled, and three months substituted.

Bucks Appeal Court has dismissed an appeal for F. J. Simmons (46, grade 2), electrician to Mr. H. Lewis, and he was recommended enlistment on army transport work.

Before the Northants Appeal Court, an appeal was made against final exemption granted by the Brixworth Tribunal to A. E. Seaton (39), electrician at Cottesbrook Hall, where there is a Voluntary Aid Detachment Hospital. He was given open exemption until September 1st.

At Bath, the Electric Tramways Co. defended a military appeal against F. Gillham (30, grade 2). It transpired that the Board of Trade had sent instructions to suspend the calling up of tramway employés, and application for review of current exemptions, until further instructions were received, and the application was withdrawn.

At Oldham, a platelayer (48, grade 1), appealed for by the Corporation Tramway Department, was given exemption until December 31st.

Warwick Rural Tribunal has granted exemption on his enrolling as a National Service Volunteer, to E. C. Cotton (47, grade 1), electrician at the Siddeley-Deasey Works.

At Ashford, Kent, L. Burch (50, grade 2), electrician, of High Street, was granted six months' exemption, and excused volunteer service.

At Rochdale, on the recommendation of the Advisory Committee, exemption until November 30th has been granted to A. Clegg (42, grade 3), driller, appealed for by the Corporation Tramways Committee, and to C. Collinge (39, grade 1), stated to be indispensable in connection with repairs to the tramway track.

At Reigate, with the assent of the National Service representative, six months' exemption has been granted to C. Parsons (46, grade 2), foreman electrician with Messrs. Tamplin & Makovski, electrical engineers.

High Wycombe Rural Tribunal has given six months' exemption to F. Wooton (45, grade 2), electrical engineer, of Little Marlow.

LEGAL.

Poyzer *v.* Priestman Collieries, Ltd.

At Newcastle County Court, H. Poyzer, Blaydon, stoneman, applied for compensation for the loss of his son, who was killed at the colliery by an electric shock. Plaintiff said that deceased and another lad were waiting, according to order, at a place where there was stretched across a pipe which everybody in the pit thought carried water to the stables. There was no notice to indicate that it was an electric appliance. The lads had their hands on the pipe when it came away. Poyzer was killed outright by electric shock, and the other lad was seriously injured. Mr. Meynell (for the respondents) said the lads had nothing whatever to do in the place. Their duty when they came from the bottom of the shaft was to go on the inclines to relieve the boys there.

His Honour came to the conclusion that there was no order for the boys to wait in this place; that they were not in the place in the course of their employment; and that the accident did not arise out of or in the course of their employment. There would be an award for the respondents.

Damages Award Against the L.C.C.

At Lambeth County Court, on August 15th, C. H. Martin, employed at the G.P.O. on the outside telegraph staff, was awarded £48 damages, with costs, against the L.C.C. Plaintiff was travelling on a top seat of a tramcar when the car collided with another one, throwing him forward against the seat in front and fracturing two of his ribs.—*Evening Standard*.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Wagner & Co., Saint Etienne (Loire). (H. Sloog, London).—Descriptive catalogue of portable electric drills of various sizes for D.C. and A.C., with illustrations, tables of dimensions, spare parts, &c. Universal motors for D.C. or single-phase A.C. are included, as well as tapping devices and various accessory apparatus.

Higgs Bros., Dynamo Works, Summer Hill Street, Birmingham.—Stock list of shunt-wound motors, 0·17 to 28 H.P.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 4,110, dealing with lever switches for main circuit, field, starting, and isolating switches, with descriptions of special features of each switch for ratings ranging from 250 volts, 100 amperes, to 650 volts, 10,000 amperes, and 11,000 volts, 1,200 amperes.

National X-Ray Reflector Co., 235, W. Jackson Blvd., Chicago, Ill.—Leaflets relating to industrial, show-case, and flood lighting.

Book Notices.—"Free Trade or Free Production?" By J. S. Hecht. Pp. 20. London: P. S. King & Son, Ltd. Price 6d. net.

"Science Abstracts." Vol. XXI. Part VII. July 31st, 1918. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"A Scheme for the Syndication of the Brass Industry." By H. F. Smith. Second Edition. Birmingham: Smith & Davis, Ltd. Gratis.

"Coal Saving by the Scientific Control of Steam Boiler Plants." By D. Brownlie, B.Sc. London: *Engineering*.

Holidays.—The works and offices of Messrs. E. Brook, Ltd., Empress Works, Huddersfield, will be closed on Thursday night, August 29th, until Monday morning, September 9th.

Messrs. Pooley & Austin state that, owing to staff holidays, only most urgent correspondence is being dealt with between August 17th and 31st.

The works and offices of Messrs. Fleming, Birkby & Goodall, Ltd., Woodfield Mills, Liversedge, Yorks., will be closed from Saturday, August 31st, to Saturday, September 7th, inclusive, for the annual holiday.

Non-Ferrous Metal Industry Act.—Further lists of companies, firms, and individuals licensed under this Act are given in the *London Gazette* for August 20th.

Meeting of Creditors.—At Manchester, on August 14th, the adjourned meeting was held of the creditors of W. T. Smith, electrical engineer and inventor, of Bolton, whose liabilities were put down at £3,005 and assets at £128. The proposal was to pay unsecured creditors a composition of 5s. in the £ in full discharge of debt, this sum to be placed in shares of a limited company to be formed. The Official Receiver said there had been little response from the creditors to the proposal. The debtor was asked if other patents were producing money now, and he replied, "Yes, so far as we can get supplies from the machinists. We are short of materials, and many orders are waiting completion." The debtor added that he was two years ahead of the War Office. He had been unable to get them to look at his patent, but was now getting at them through a large firm. The Official Receiver suggested that the debtor canvass the creditors to accept his proposal, though it would have been better had he offered 5s. in the £ in kind rather than in shares. The meeting was adjourned to November 13th.

Malay Rubber.—According to the *Times* correspondent at Singapore, the rubber position is creating extreme anxiety throughout Malaya in consequence of the virtual stoppage of shipments to America. Several estates have already stopped tapping and are discharging labour, but Indian and Chinese labourers cannot be repatriated owing to shortage of shipping.

Italy.—The firm of Franco Tosi, of Legnano, which hitherto was one of the largest, if not the largest, private electrical concerns in Italy, has now been converted into a *società anonima*, with a capital of 64,000,000 lire. The board now comprises, besides the Tosi family, representatives of the Banca Commerciale, the Banca Italiana di Sconto, the Borletti group, the Credito Italiano, and the Ferriere Lombarde, which betokens the important *rôle* which the firm is destined to play in the future industrial life of the country. It is intended shortly to increase the capital to 80,000,000 lire, in order to absorb the Officine Insubri and the Società Elettrotecnica Galileo Ferraris. The two last-named firms were formerly the German concerns of Langen & Wolf and a branch of the A.E.G. respectively, and our contemporary *l'Elettrotecnica* opines that the old patrons of the German undertakings may eventually seek to disturb the pure Italian character of the new amalgamation.

The Società Ansaldo e Ca. has increased its capital from 100,000,000 to 500,000,000 lire. This company has become the largest engineering concern in Italy, with many and varied establishments, including electric machinery works started some 18 years ago. It has launched out into electric installations, and has already in the valley of the Aosta installations, concessions, and constructions to a total capacity of 200,000 H.P., for the working of electric steel works and the exploitation of mineral deposits.

The Società Anonima Forni Elettrici Stassano, in liquidation, Turin, closes its liquidation balance with a loss of 350,000 lire, which, after re-imbursing 15 lire per share, leaves available 35,987 lire, permitting the allotment of 7·92 lire to each of the 4,540 privileged shares.

Liquidations. — Asuncion Tramway, Light and Power Co., Ltd.—Winding-up voluntarily, with Mr. B. H. Bender, 80, Bishopsgate Street, E.C., as liquidator. A meeting of creditors was held on August 21st last. Particulars of claims to be sent to liquidator by September 17th.

Devonport and District Tramways Co.—Creditors must send the usual particulars to the liquidator, Mr. P. N. Gray, Manchester Hotel, Aldersgate Street, E.C., by August 27th.

Trade Announcement.—The business formerly known as F. A. Butler & Co., of Edinburgh Road, Walthamstow, will in future be known as the East London Mica Co., Ltd., Omega Works, Ringwood Road, Walthamstow, E. 17, where larger premises have been taken.

LIGHTING AND POWER NOTES.

Aldershot.—Electric Light Failure.—With reference to our note last week under the above heading, we understand that there was no such failure on the date mentioned.

Argentina.—Coal Substitute.—The *Review of the River Plate* states that during the recent strikes in Buenos Aires, when the German electricity supply company had great difficulty in maintaining a supply for want of fuel, the Compania Italo-Argentina de Electricidad placed no restrictions whatever upon consumers. This was possible owing to the use of fuel made up of 50 per cent. of petroleum and 50 per cent. of sawdust, bran, and pollards.

Ashton-under-Lyme.—Price Increase.—The Electricity Committee has increased the charges for electricity, from the June quarter, as follows:—D.C. power, to 50 per cent. over pre-war prices; private lighting, to 1d., plus 25 per cent. over pre-war rates; the cash discount is to be reduced to 2½ per cent., and energy supplied to the tramway department to be advanced to 1·7d. per unit net.

Australia.—Hydro-electric Scheme.—At a meeting of delegates of the North-Eastern Municipalities of Victoria, it was stated that the promoters were prepared to spend £1,000,000 on the development of the Kiewa hydro-electric scheme, which is to supply energy to the towns between Albury and Melbourne. The Minister of Water Supply said the Government was not opposed to the scheme, but was considering whether the scheme was to be a Government one or a private enterprise. A motion was carried recommending that a deputation should urge the Government to declare its attitude in regard to the application of the Victorian Hydro-Electric Co. for concessions to harness Kiewa river, or to go on with the scheme as a Government concession.

Victoria.—The Premier of Victoria has announced that the preliminary work in connection with the Morwell power-house scheme is to be undertaken at once. This is estimated to take two years, and it is not thought necessary to order the plant required until it is completed. The cost of the scheme is approximately £1,750,000.

Aylesbury.—Price Increase.—The T.C. has decided to further increase the price for energy by 20 per cent., and that the charges for the supply to the works of Mr. Jas. Putman be advanced from 30s. to £2 per KW., and from 1d. to 1½d. per unit.

Canada.—Water Power.—The International Waterways Commission is considering applications by private American interests for the development of the Long Sault Rapids power project, and by the New York and Ontario Power Co. for approval of its plans to reconstruct, repair, and improve its dam and water-power properties at Waddington, on the St. Lawrence River. Opposition to the applications is being filed by the Canadian Government, which contends that the companies' schemes would interfere with the economic development of the St. Lawrence as regards navigation and power potentialities, and by the Dominion Marine Association in the interests of safe navigation.—*The Times.*

Cardiganshire. — Hydro-Electric Scheme. — The Council has approved a proposal submitted by the Finance Committee with reference to a scheme for generating electricity from the resources of the rivers Rheidol, Ystwyth, Aeron, and Teify.

Colchester.—Loan Sanction.—The T.C. has received sanction to a loan of £5,188 for additional plant at the electricity works.

Continental.—Germany.—Before the war the A.E.G. put down at Bitterfeld, close to important lignite deposits, a large electric generating station, the capacity of which was to reach 140,000 H.P. The energy was to be transmitted to Berlin. When the war broke out the State purchased the energy and utilised it in large electrochemical works which were rapidly put down. It was stated that the A.E.G. sold electricity at the rate of 0·9 pf. (0·108d.) per KW.-hour; the statement was also made that power stations which utilised lignite could generate electricity as cheaply as the Swiss hydro-electric plants. It was found later, however, that for the concern to pay, energy should be sold at 1·5 pf. (0·18d.) per KW.-hour at the switchboard; and although the State works later increased the price they paid, the A.E.G. was the loser. Owing to the heavy outlay incurred by the construction of this generating station, the A.E.G. company was obliged last spring to increase its capital, and the directors stated at the general meeting that the hopes which had been placed upon a power station utilising lignite as fuel did not all come true, adding that the experience gained at Bitterfeld showed that for the electrochemical industry the required energy should be obtained from hydro-electric power stations. It appears that, notwithstanding the improved mechanical appliances used for extracting the lignite, a large amount of labour was necessary. The removal, first, of a layer of earth about 12 ft. in thickness appeared to be a particularly costly undertaking. The maintenance of the large boilers also leads to a heavy outlay. It is doubtful whether electricity can be obtained at a price below 1 pf. (0·12d.) per KW.-hour. Since the Bitterfeld plant sold to the State the greater part of the energy generated (a total of 300,000,000 KW.-hours last year) it was to be expected that the State would finally purchase the plant, and this has recently been done. The price of the station was about 28,000,000 marks, that of the land and lignite deposits 6,000,000 M., and that of the mining installations was also about 6,000,000 M. The State now works the station in the form of a company with share capital.

Bavaria.—Important establishments for the production of nitric acid from the air are to undergo considerable extension, in which some 200,000 H.P. of water-power will be used. A syndicate of bankers has been formed to carry out the scheme, involving a capital of 150 million marks.

Dewsbury.—Price Increase.—The Electricity Committee has decided that, from the end of September, the charges for electricity shall be increased by a further 10 per cent. for power and heating; 5 per cent. for lighting, and 5 per cent. for energy supplied on the rateable value system.

Dublin. — Hydro-Electric Scheme. — The Dublin and Lucan Electric Railway Co. is promoting a scheme for the generation of electricity by the utilisation of the Salmon Leap Fall, at Leixlip, on the River Liffey. It is proposed to increase the present fall of 17 ft. 2 in. to one of 40 ft., and it is estimated that 2,000 H.P. will be obtained for six months of the year, while the promoters are satisfied that the minimum horse-power that can be generated is 1,800 for 183 days, 900 for 90 days, and 450 for 92 days each year. It is estimated that the annual saving in coal consumption will amount to 16,464 tons. The scheme will cost £50,000, and includes the acquisition of the Salmon Leap Mill and the installation of one 1,000-B.H.P. turbo-generator and two of 500 B.H.P. each. Already inquiries for power aggregating 3,000 H.P. have been received, including demands for an immediate supply to aerodromes, woollen, flour, and paper mills, hospitals, &c., in the district. An arrangement has been agreed upon for the supply of power to the Dublin Corporation during the winter months, and by the Corporation to the Railway Co. during the summer months, when the water-power supply will be at its lowest; the charge proposed is 1d. per unit in each case. The scheme has the approval of the Dublin Corporation and Chamber of Commerce, the English and Irish Coal Controllers, and of Lord Decies, who is the owner of the water rights. It is suggested that the entire capital expenditure should be granted by the Government, which is already committed to the extent of £3,000 per annum towards the working of the railway during war time.

Exeter.—Year's Working.—There was a gross surplus of £9,182 on the working of the Corporation electricity department for the past year, the net surplus being £1,348, against £2,043 in the previous year.

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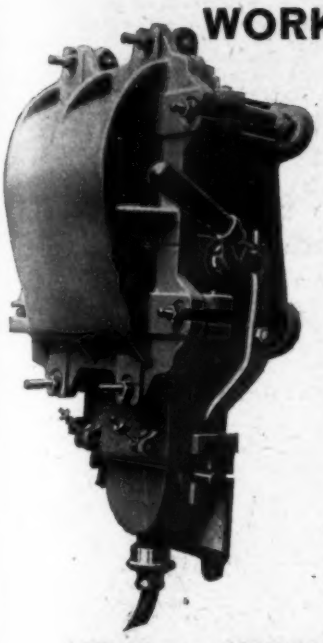

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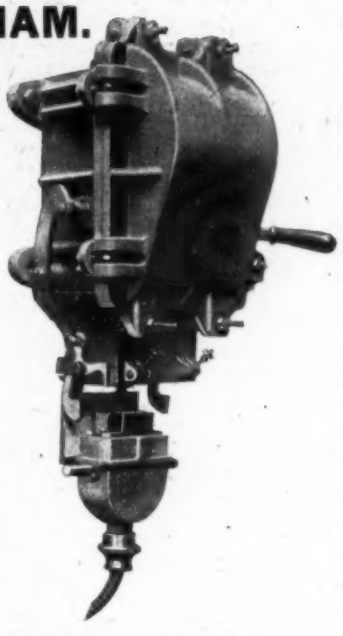
1½" machined facings between box and lid.

Plug Contacts are in separate Chamber.

The Plug cannot be inserted the wrong way or withdrawn while current is on.

Substantially made to withstand rough usage.



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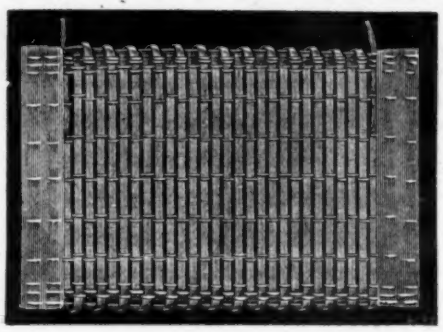

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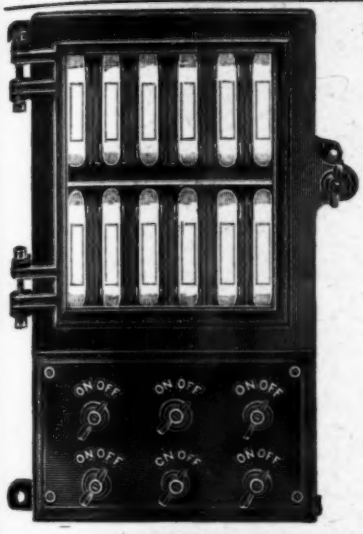

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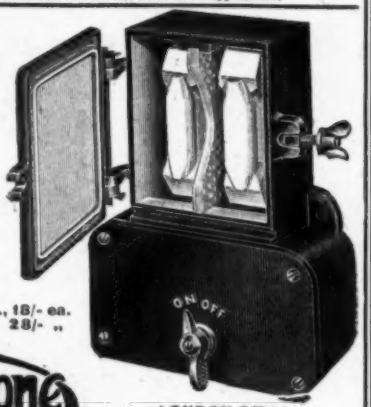

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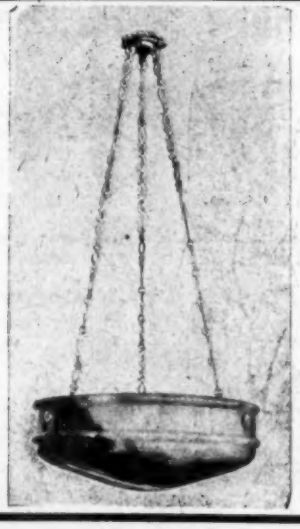

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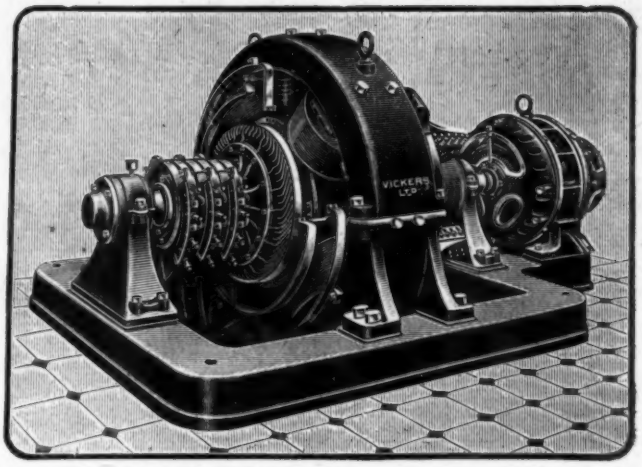

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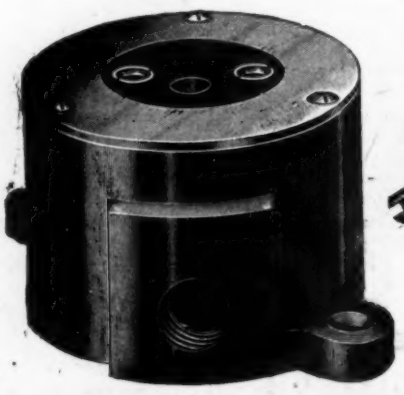

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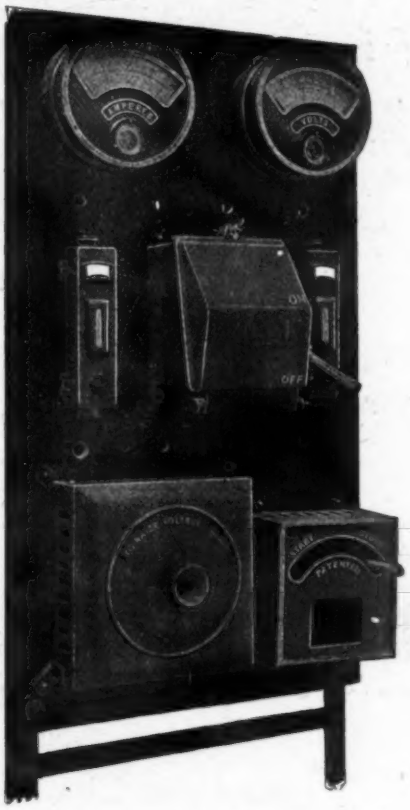

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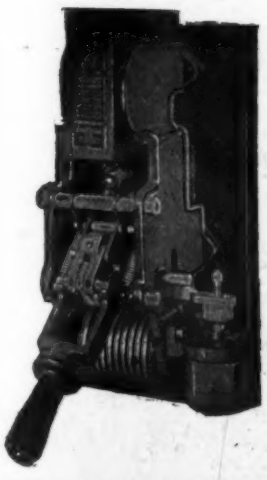

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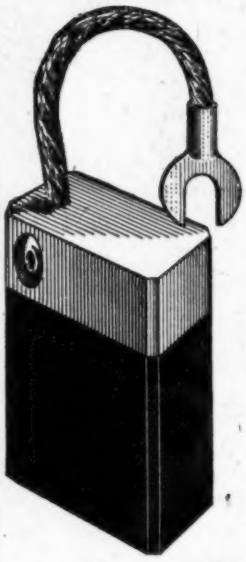

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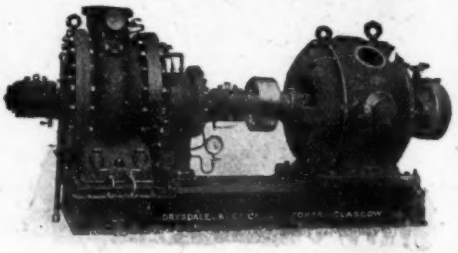

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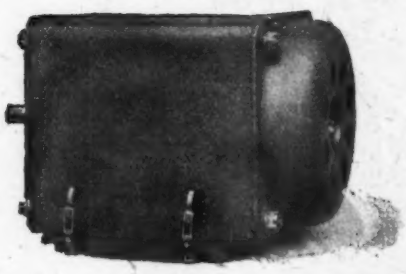

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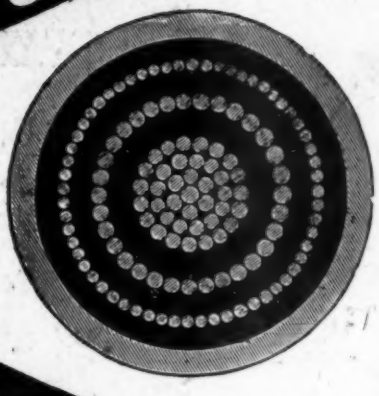

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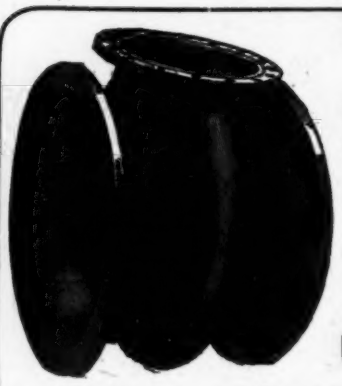

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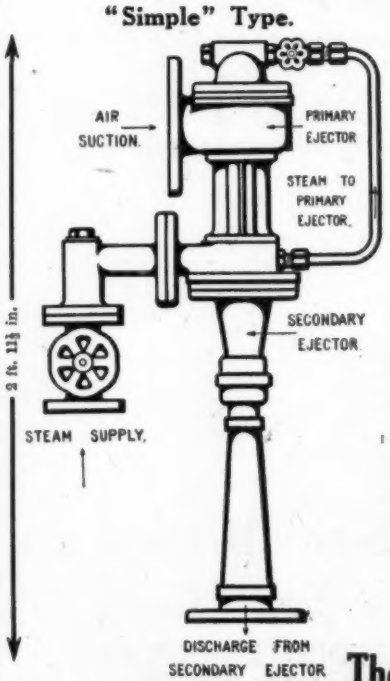

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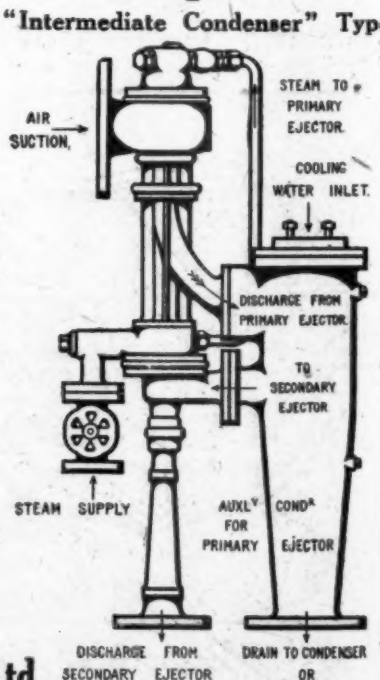

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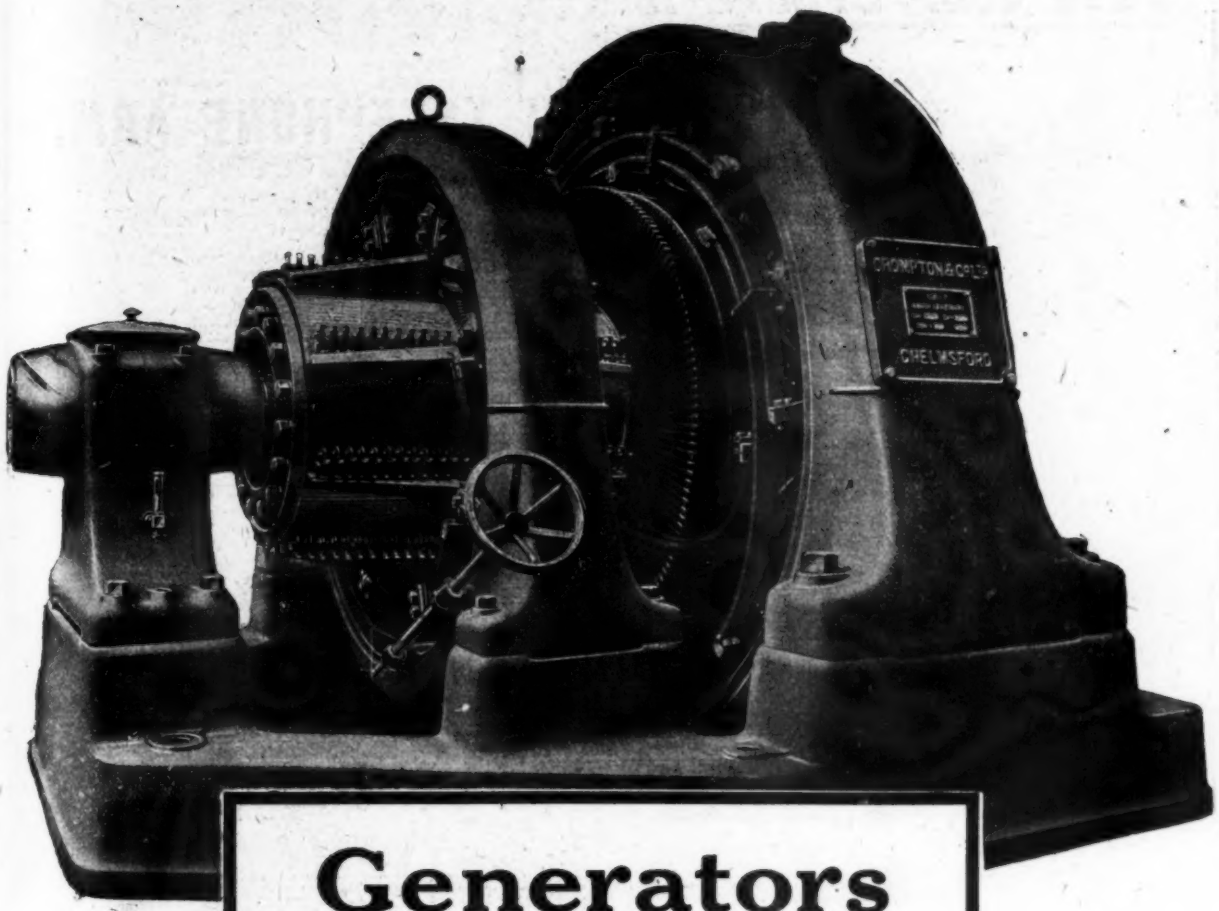

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AN INDISPENSABLE adjunct to every well equipped and up-to-date office. It has the following advantages:—

Telephone always in the one place when out of use at will.

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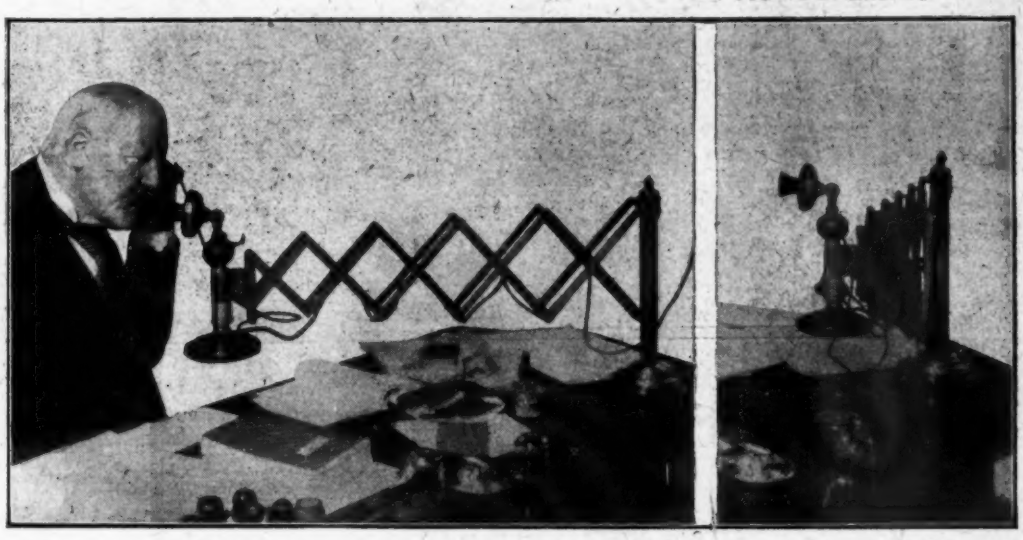

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One instrument easily accessible by two or more people without disturbing the other man.

Roller bearing where greatest stress occurs.

No twisting of cord.

Cord is absorbed in the fitting open or closed.

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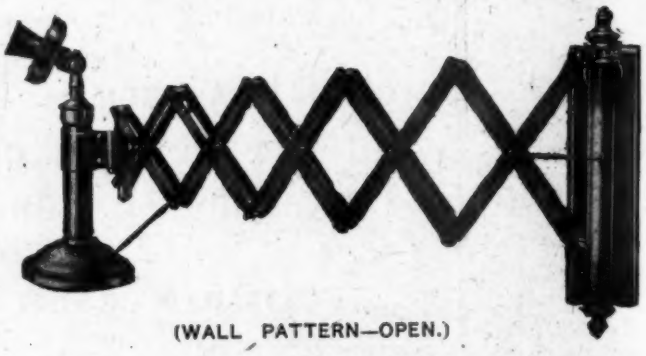

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THE "ELECTRICAL REVIEW"

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SITUATIONS VACANT.

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ASSISTANT CHARGE ENGINEER.

ASSISTANT CHARGE ENGINEER wanted. Applicants should have had mechanical and electrical training, and experience in the operation of D.C., H.T. and E.H.T. supplies.

Wages £2 10s. per week, plus 20s., plus 12½%.

Apply, stating age and experience, to ENGINEER AND MANAGER, West Ham Corporation Electric Supply, 84, Romford Road, Stratford, E. 15. 2305

SITUATIONS VACANT.—*Continued.*

COUNTY BOROUGH OF BARNSLEY.

Electricity Department.

SHIFT ENGINEER.

WANTED, SHIFT ENGINEER, experienced in E.H.T.—A.C and L.T.—D.C. 3-wire supply, with Rotary Converters.

Salary £150 per annum, plus 12½%.

Applications, stating age, training, experience, medical classification, and date when able to commence duties, accompanied by not more than three recent testimonials, to be addressed to MR. T. W. HIBBERT, Acting Borough Electrical Engineer, Electricity Works, Barnsley, endorsed "Shift Engineer."

W. P. DONALD,
Town Clerk.

August 17th, 1918. 2354

THE POLYTECHNIC, 309, REGENT STREET, W. 1.

Electrical Engineering Department.

APPLICATIONS are invited for the following appointments:—

(*a*) Teacher of Electrical Engineering for Evening Classes, two or three nights per week.

(*b*) Teacher for instructing Disabled Soldiers in Electrical Wiring for light, power, bells, telephones, &c.; good practical electrician required.

Apply by lettter, giving full particulars of age, qualifications, experience, accompanied by copies of testimonials, to the Director of Education. 2353

WALTHAMSTOW.

Engineering and Trade School.

Head Master: J. G. EDWARDS, Esq., A.M.I.M.E.

REQUIRED immediately, a Teacher of Engineering with Degree. Salary £250, with additional £25 for evening work. Apply at once to R. DEMPSEY, 1, Selborne Road, Walthamstow, E. 17. 2348

JUNIOR ASSISTANT.

WANTED, Junior Assistant in Mains Department. Salary to commence about £170 per annum.

Apply stating fully experience, &c., to FIFE ELECTRIC POWER Co., 8, New Row, Dunfermline. 2304

STOKER.

STOKER required at Eastbourne Electricity Works—mechanical stokers. Wages for a 48-hour week, including all bonuses, £2 5s.

Apply to the BOROUGH ELECTRICAL ENGINEER. 2374

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

SWITCHBOARD ATTENDANT.

WANTED (for a certified undertaking), Shift Engineer, also Switchboard Attendant, for working seven eight-hour shifts per week, with experience in the operation of direct-current supply, Willans engines, mixed pressure steam turbines, and condensing plant. Preference given to shift engineer who has had experience in the handling of steam boilers. Salary of shift engineer, inclusive of all bonuses, £208 per annum. Wages of switchboard attendant, inclusive of all bonuses, £2 16s. 3d. per week of 56 hours.—Apply, with copies of three testimonials, stating age and when at liberty, to the ELECTRICAL ENGINEER, Electrical Engineer's Office, Craven Street, Birkenhead. 2385

ROYAL VICTORIA INFIRMARY, NEWCASTLE-UPON-TYNE.

ELECTRICAL ENGINEER wanted to take charge of Electrical Installation of a large General Hospital of 600 beds, lighting, lifts, motors, dynamos, &c., for duration of war. Must be experienced in the use and care of apparatus used in electrical treatment, X-ray work, &c., &c.

Full particulars can be obtained from the—

HOUSE GOVERNOR & SECTETARY,
Royal Victoria Infirmary,
Newcastle-upon-Tyne.

14*th August*, 1918. 2350

SHIFT ENGINEER.

SHIFT ENGINEER wanted for certified undertaking. Must have good experience with Steam Plant and E.H.T. Rotary Converting Plant, and proper technical training. Salary £192 per annum inclusive for all time worked.

Apply stating particulars of age, training, &c., and copies of recent testimonials, to 2321, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

NORTHAMPTON CORPORATION TRAMWAYS.

WANTED, Two Switchboard Attendants, practical men, accustomed to D.C. generation for tramway supply.

Give two references and state wages required immediately to :—

JOHN F. CAMERON,
Tramways Manager.
Northampton. 2365

JUNIOR SHIFT ENGINEER.

JUNIOR SHIFT ENGINEER required. Should have experience in the running of high-speed D.C. steam sets and rotary converters. 55s. per week inclusive ; no night shifts.

Apply with references—

BOROUGH ELECTRICAL ENGINEER,
Electricity Works,
Heywood, Lancs. 2384

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT required, three-wire D.C. and A.C. H.T. Station, certified establishment.—Apply stating age, full particulars of experience, wages required, to the ENGINEER, Barking U.D.C. Electricity Works, Barking, Essex. 2392

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT wanted for Power Station near London ; must have had experience with D.C. and E.H.T. 3-phase plant. Wages 50s. per week, plus 12½%.—Apply CHIEF ENGINEER, Electricity Works, Luton, stating age and experience, with recent testimonials. 2391

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE required. Preference given to one having alternating current experience ; single-phase. Salary £163 16s., inclusive of war awards.

Apply, with full particulars, to the BOROUGH ELECTRICAL ENGINEER, Tunbridge Wells. 2377

CHARGE ENGINEER.

CHARGE ENGINEER wanted, with experience of D.C. 3-wire station, combined with refuse destructor.

Apply, stating, age, experience, together with testimonials and wages required, to BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, Bury St. Edmunds. 2342

SITUATIONS VACANT.—*Continued.*

SHIFT ENGINEER.

WANTED, a Shift Engineer at the Stretford Electricity Station. —Applications, stating experience, to be addressed to R. ROWLAND, Engineer, Electricity Works, Chester Road, Stretford, from whom particulars as to wage and bonus may be obtained. 2393

ELECTRICIAN WANTED.

WANTED, an Electrician, Urgent.
Apply, D.O.R.E., Shorncliffe. 2362

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ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Engineer, wanted for London central station, salary, including bonus, £259 and residence.—Full particulars, to 5353, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer wanted for small undertaking ; capable of executing repairs on consumers' premises and mains work. Knowledge of Diesel engines preferred. Salary £150. Must be low category.—2318, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CABLE Jointer (first-class), required for E.H.T. and L.T. cables.—Apply, stating age, experience, wages required, &c., to THE SCOTTISH CENTRAL ELECTRIC POWER CO., Kirk Wynd, Falkirk. 2315

CALIBRATORS for moving coil and moving iron instruments. Good wages. Write stating experience and salary required. North London district. Men on Government work, or over 10 miles distant, need not apply.—2322, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Test Room Assistant wanted. Experience with contactor gear an advantage but not essential, good prospects if suitable. No person already on Government work will be engaged. —Apply, giving full particulars of experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5824. 2265

COAL Cutters.—Compressed air and electric—Man wanted with knowledge of their use and mining conditions, to advise purchasers, and follow up colliery business generally. Discharged soldier would have preferential consideration. No person resident more than 10 miles away, or already on Government work, will be engaged. State age, experience, salary expected.—2376, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted, used to Switch and Fuse designing and estimating in S.E. district. No person resident more than 10 miles away, or already on Government work, need apply. —Write, stating age, experience and salary required, to 5355, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, with experience in the design of Switchgear. Progressive permanent position for the right man. Discharged man preferred. No one already on Government work, or living over 10 miles from Charing Cross, need apply.—State experience, salary and age, to 2379, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN wanted, preferably used to H.T. and L.T. switchboard work ; London district. No person resident more than 10 miles away, or already on Government work, will be engaged.—2368, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Motor Mechanic, experienced in repairs to small motors ; permanent progressive job for the right man. State age, experience and wages required. No person resident more than 10 miles away, or already on Government work, will be engaged.—2256, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Vehicle Garage and Battery Depôt (London).—Several young men are required as assistants on all classes of vehicle battery work. Technical knowledge and experience in electrical work is desirable, and opportunities will be afforded to qualify as outdoor battery inspectors. Commencing wages at the rate of 38s. per week, plus 3s. war bonus, plus 12½ per cent., for a 50-hour week. An Electrician with an all-round experience, including accumulators and machines (D.C. and A.C.), is also required as Working Foreman ; rate 1s. 3d. per hour, plus 3s. war bonus, plus 12½ per cent. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—2317, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

ELECTRICAL Fitter required for general maintenance, used to A.C. work; good references required. Standard rate.—Apply, MANAGER, Electric Power Station, Brimsdown, N. 5345

ELECTRICAL Wireman wanted (Warrington district); only first-class man for screwed, tubing and general work. Manchester rate. Give full particulars of previous employment. Government work. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No A5896. 2373

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER-Driver required for 1,000-KW. D.C. Power Station in Government Controlled Establishment. Must have good experience with Corliss engines and Lancashire Boilers. Permanent situation to qualified and capable man. No person already on Government work will be engaged.—Applicants are requested to give full particulars of apprenticeship, training, experience and wages required, to their nearest EMPLOYMENT EXCHANGE, quoting reference No. A5903. 2387

FOREMAN Armature Winder.—Wanted a competent man, capable of supervising male and female labour; must be good organiser and have an expert knowledge of small dynamo work; permanency and good prospects for the right man. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply JOSEPH LUCAS, LTD., 224, Shaftesbury Avenue, W.C. 2. 5324

FOREWOMAN or Foreman to take charge of and develop Winding Shop for small Motors in London. Experience essential. First rate opening, permanency, good wages. No person resident more than 10 miles away, or already on Government work, will be engaged.—2282, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

IMPROVER required for three-wire D.C. station (Certified Undertaking), must have good theoretical training.—Apply, stating age, experience, salary required.—ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2380

JUNIOR Assistant Electrical Engineer, with good theoretical and some mechanical training. Opportunity to gain good general experience.—Apply stating age, experience, salary required, testimonials and form of military exemption, ELECTRICAL ENGINEER, Electricity Works, Grays, Essex. 5254

OVERHEAD Linesman.—Apply, stating age, experience and wages required, MANAGER, Birkenhead Tramways. 2366

SHIFT Engineer wanted in combined A.C. and D.C. station. Salary £175 per annum.—Apply, stating age and experience, to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Dover. 2378

STOREKEEPER, with knowledge of electrical accessories, required by electrical contractors. No person resident more than 10 miles away, or already on Government work, will be engaged.—Reply, stating salary and experience, 2367, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SUB-STATION Attendants are required by a large Metropolitan Electricity Undertaking. Experience with three-wire distribution and modern three-phase converting machinery essential. Wages to commence (inclusive of all bonuses) 56s. per week of six 8-hour shifts.—Apply, stating age and experience, to 2388, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted, for Certified Undertaking, with D.C. and three-phase experience. Wages 45s., plus 12½ per cent.—Apply, stating age and experience, to ELECTRICITY WORKS, Twickenham. 2389

SWITCHBOARD Driver for D.C. station (certified undertaking), gas and Diesel engines.—Apply, stating experience and wages required, ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2382

TEST Assistant, with technical knowledge and experience of D.C. and A.C. machines. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write SUBMERSIBLE MOTORS, LTD., Southall, Middlesex. 5263

SITUATIONS VACANT.—*Continued.*

WANTED, Assistant for Purchasing Department of engineering works, experienced correspondent with knowledge of materials and routine. No person already on Government work need apply.—Apply stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5854. 2301

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by leading Insurance Company, Electrical Engineer to act as Inspector of Electrical Machinery in the Leeds district. Must have experience of A.C. and D.C. machinery and workshop training. Commencing salary £150 per annum, plus war bonus, with increases according to merit. State full qualifications, age and experience. Must be ineligible for military service.—2371, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electrician, with suction-gas engine experience, to run small town installation in North Wales. Work of National importance.—2372, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Engine Driver in country electrical station; gas and Diesel engines; good wages to capable man; services required immediately.—Apply, ENGINEER, Electricity Works, Ascot, Berks. 5368

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED, Managing Engineer for Public Electrical Supply Undertaking. Station capacity (steam and Diesel engines) 700 KW.—Write, stating experience and salary required, to Box 'B,' Electrical Press, Ltd., Fisher Street, Kingsway, W.C. 2395

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WHOLESALE House require a smart man for counter; good all-round knowledge of electrical accessories essential. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating experience, wages, &c., to 5371, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS' Accountant wanted in large engineering firm in London. Applicant must have held similar position in large works. Permanent post war position. No person resident more than 10 miles away, or already on Government work will be engaged.—5329, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Manager wanted, must have good experience in accurate production of parts on Capstans, Milling Machines, Presses, &c., for electrical parts in brass and insulating materials. Salary for really good man, £450 with prospects of increase. No person already on Government work, or living more than 10 miles away, engaged.—Replies in confidence, stating experience, to 2386, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.

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ADVERTISER, Electrical Engineer, desires change; 12 years' experience; contracting, estimating, supervision works or shipyards; sound practical and commercial training.—5357, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, Engineer and Manager, Electric Lighting and Power Station, desires change. 16 years' experience in erection and maintenance of plant and mains, and accustomed to the control of men. Commencing salary £260.—5334, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ADVERTISER seeks change, thoroughly experienced in estimating, preparing lay-out, buying, and generally supervising Admiralty and Mercantile ship installations, also power and lighting ashore; Government work on Clyde preferred.—5328, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Commercial Manager, 14 years' general supply station and contracting experience, desires post progressive firm. Ineligible, energetic, highest refs. — 5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Clerk (ineligible), many years electricity and tramway undertaking; also varied accountancy and costing experience, including motor-'bus department, desires change.—5331, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CLERK, 15 years' electricity supply, desires change. Part outdoor work preferred as meter reader or collector. Experienced in electrical costs, stores, and office. Salary 75s. Age 35.—5354, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, specialising in electro-plating, is free to accept responsible position where such knowledge can be utilised. Would lay-out and supervise erection and operation of plant for quantitative production.—5379, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, discharged, thoroughly experienced at construction and maintenance of large factory or works, capable of taking full responsibility.—5341, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (Grade 3) desires responsible permanent position, home or abroad. — 5350, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (Grade III) first-class theoretical training; eleven years' practical experience in manufacture, test room and installation of electrical machinery requires post.—5369, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, discharged, thoroughly experienced, power, lighting, construction and maintenance of factory plant.—5342, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, mechanic, seeks employment of national importance (44), medical category grade 3. — BRAY, 180, Finborough Road, S.W. 10. 5358

ELECTRICIAN, nine years' power station experience, D.C. supply, experienced in batteries, dynamos, wiring, &c.; thoroughly conversant with steam and internal combustion engines; West Country preferred; army discharge final. — 5361, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN wants work of national importance; Grade 3, age 38; power station preferred. — 5295, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN-Wireman, charge or otherwise, seeks position national importance. Own business closed owing to war.—5348, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN-Wireman seeks situation; lighting and power, factory or private plant. — A., 28, Cavendish Dwellings, Allen Street, E.C. 1. 5352

ENGINEER, electrical and mechanical (44), ineligible (deafness), 25 years' experience technical, contracting, station, mains (E.H.T. and L.T.). Charge small station or mains work.—5309, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER (Electrical), in charge of a department on inspection, desires position with manufacturers; shortly disengaged.—5332, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, mechanical and electrical training, contracting, central station and works experience, desires responsible post. Resident engineer or assistant. Salary £200—£250. References. —A. GOING, 49, Rosedale Road, Forest Gate, E. 7. 5330

FOREMAN, or leading Overhead Linesman, seeks situation. Experience in erecting and repairing E.H.T. and low-tension transmission lines.—5339, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

FOREMAN-Electrician, practical, with good business training and more than average ability and energy, desires position of trust with prospects, estimating, buying, control of men, &c.; must be war work.—5312, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LAD (16), considerable experience in wiring, seeks situation as wireman's mate.—5298, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER or Foreman, Electrician-Engineer; power, plant traction, wiring, distribution, estimating, &c. Over 20 years' experience.—5259, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant, ineligible, experienced in alternating and 3-wire D.C. switchboards.—5247, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THOROUGHLY practical and technical man seeks situation as Foreman or Manager of small works. Accustomed to the latest methods of production, estimating and progress. Wide experience of instrument work.—5362, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TRAVELLER. Engagement required for country. Has good conection electrical factors, contractors, motor car and aircraft builders.—B., 8, Blythe Hill, Catford, S.E. 6. 5336

WIREMAN'S Mate, disengaged, age 39, ineligible. — H.M., 2, Sewardstone Road, Old Ford, E. 2. 5351

YOUNG Electrical Assistant desires post; theoretical and practical knowledge of installations, 12 months with electric supply authority, all-round experience. Age 16 years.—5343, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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FIRM of manufacturers and suppliers of electric traction overhead line fittings, electrical accessories, moulded electrical insulation, and electrical insulating materials, require first-class energetic Representatives for following districts:—(1) Yorkshire, Lancashire, Cheshire, and North Wales; (2) Midlands; (3) South Wales; (4) South of Midlands, excepting London and district; (5) South-east, excluding London and district; (6) Scotland. This organisation is required principally for after-the-war trade.—Apply with full particulars as to experience and remuneration to 2291, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

MACHINERY FOR SALE.

FOR SALE, at Clearing-out Prices before Stocktaking:—

One 2-pole Dynamo, by Laurence, Scott & Co., 150 volts, 25 amps. with pulley and slide rails; just removed from gentleman's mansion. This is an old-type machine, but in thoroughly good condition and guaranteed. £19.

Two Ferranti Meters, capacity 200 volts, 200 amps.; readings 1 to 10,000 units. £3 each.

One brass-cased Amperemeter, readings 0 to 150 amps., large, heavy instrument. £3 10s.

Two brass-cased Voltmeters, readings 0 to 250 volts. 50s. each.

Two Ditto, readings 0 to 350 volts. 50s. each.

One Ditto, readings 0 to 150 volts. Large size, £3. All above are in perfect order.

One Slate Switchboard, with Voltmeter, 0 to 120 volts, fitted with two double-pole switches. £3 10s.

Quantity of Electrical Fittings, consisting of Switches, Shades, Insulators, Junction Boxes, &c., some new, some been in use, all removed from a mansion. Price £7 10s. the lot, worth double. Sent on approval.

COOK, 5, Elton Road, Bishopston, Bristol.
Telegrams: "Exhaust Bristol." 'Phone: 757. 2319

(Continued on next page.)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

CROSS Comp. Hori. Drop-valve Engine, by Robey & Co., with 16″ and 26½″ cyls., 36″ stroke.
Cross Comp. Hori. Engine, by Riches & Watts, with cyls. 13″ and 22″ diam., by 30″ stroke.
Hori. Tand. Corliss Cond. Engine, by Woods & Co., with cyls. 13″ and 20″ diam., by 36″ stroke.
Vert. Comp. Engine, by The Brush Co., with cyls. 9″ and 15″ diam., by 10″ stroke.
3″ by 36″ All-geared head Flat Capstan Lathe, by Jones and Lamson.
3½″ Centres "Lo-Swing" Lathe on 8′ bed.
Electric Driven Portable Radial Drilling Machine, by Kendal & Gent, 6′ arm, 2¼″ spindle.
Portable Screw-driven Column Type Slotting Machine, with circular motion to table, 4′ 6″ stroke.
Sellars Patent Universal Tool Grinding Machine, to take tools up to 2½″ by 2½″.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS. Free on Application. Inspection invited.
THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,

and at Milburn House, Newcastle-on-Tyne.

Tel.: { 44 Wakefield. / 867 Newcastle. } Telegrams: "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo Set, 3500 KW., 1200 R.P.M., with alternator field-rotating type and exciter complete; 6000-volt maximum load, 40 cycles.
One ditto, 1500 KW., 2-phase, 2000 volts, 50 periods.
One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.
One 225-KW. Generating-Set, engine tandem comp. type, 300 H.P., with Corliss Valve Gear, &c., B.T.H. Generator, 500 volts, compound wound.
One Surface Condenser, by J. & H. McLaren, capacity 3000 lbs. per hour, with Circulating Pump. 5277

CAST-IRON WATER PIPES.

THE CORPORATION OF MAIDSTONE have for disposal the undermentioned lengths of C.I. Water Pipe, all the pipes having flanged ends and are drilled:—

7″ bore, 1 bend, 2′ 6″ × 2′ 6″.
8″ „ 1 piece, 4′6″.
8″ „ „ 8′.
8″ „ „ 7′.
8″ „ „ 9′.
10″ „ 1 bend, 22″ × 14″.
12″ „ 1 "U" piece 4′ 4″ centres.
20″ „ 1 piece, 6′ 6″.
1 taper pipe, 7″ to 8″, 5′ 6″ long.

Offers for all or any of these pipes are to be made to E. E. HOADLEY, Electricity Works, Maidstone. 2363

FOR SALE.

5, 15, 25, 30-H.P., 440 V., D.C.; 3, 7, 10, 12, 15, 20, 25, 27-H.P., 440 V., A.C., 2 and 3-phase, 50 periods. Switches, Fuses, Starting Gear, Automatic features and Non-automatic.

Cable from 1/18 to 37/12. Ironclad Fuse Distribution Boards, with and without circuit switches, Home Office pattern. Power Circuit Breakers, 2 and 3-phase, from 100—600 amps.

Materials and workmanship, the Best. Technical advice given with quotations if required.

Your enquiries and deliveries, prompt attention.

Apply—
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Walsall. 2264

ENGINE AND DYNAMOS.

FOR SALE, One Belliss Engine, triple-compound, coupled to Siemens Dynamo, compound wound, 250 KW., 500 volts.
Two Laidlaw & Laidler Dynamos, with spare Armature, 230/260 volts, 26 kilowatts each.

Further particulars on application to—
CHIEF ENGINEER,
Borough Electricity Works,
Buxton,
to whom offers should be made before SEPTEMBER 7th. 2375

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

GENERATING SETS, D.C.

One 500-KW. Willans-E.C.C., 420/500 volts.
Three 256-KW. Belliss-Siemens, 460/500 volts.
One 220-KW. Willans-A.E.G., 220 volts.
One 200-KW. Allen-Parker, 460/500 volts.
One 180-KW. Anderson-Mavor 220/230-volt Set.
One 160-KW. Belliss-G.E.C., 460/500 volts.

TURBO-GENERATORS, A.C. AND D.C.

One 1,000-KW. A.E.G. 500 volts, 50 cycles, 3-phase, with condensing plant complete; the whole equal to new.
One 500-KW. Parsons, 460/530 volts, with condensing plant complete.

Apply, FRANK GILMAN,
Lightwoods Hill, Birmingham. 2128

GENERATOR SWITCHBOARDS.

IN perfect order and as new:—

One 100/140-volt, 10-KW. size, with circuit-breaker, &c.
One 460-volt, 45-KW. size, with shunt regulator.
One ditto, with change-over switch, and suitable for two generators.
One Battery Charging Board for 55 cells, 60 amps., by Siemens.

DRUMMOND & CO., Middlesbrough. 5249

GREAT CLEARANCE SALE.

METAL Lamps, B.C., 24/8, 24/12, 25/10, 25/16, 120/10, 125/16, 130/32; E.S., 125/32; Battery Lamps, 2 to 16 v., all 18s. doz; Centre Contact, 65/16 and 60/16 (carbon), 12s. doz.; Coloured Carbon Lamps (blown glass) 60 v., S.B.C., 100, 200, 220 v., B.C., all 15s. doz. Candle and Tubular Lamps, Flash Lamp Bulbs, Candle Fittings and Tubes, Fuse Bridges, Conduit Fittings, odd lengths Cable all sizes, High-tension Cable, Spare Parts of Everything Electrical. Definite enquiries solicited.

HOAD, 4, Duke Street,
'Phone: Gerrard 3015. Adelphi, W.C. 2. 5340

COUNTY BOROUGH OF SALFORD.

THE Electricity Department have for sale two 1,000-KW. direct-current Turbo-Generators, Willans disc and drum type, coupled to Siemens machines, voltage 440-490. Rated output 1,000 kilowatts, with 160 lbs. steam pressure. The sets are in regular commission, practically new, and can be seen in operation, by appointment. Full particulars from the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Frederick Road, Salford. Tenders are invited by 12 noon, MONDAY, SEPTEMBER 2nd, 1918.

L. C. EVANS, *Town Clerk*. 2370

MACHINERY FOR SALE.

THREE 70-H.P. Laurence-Scott Motors, D.C., 220 volts, 520 R.P.M.
One 50-H.P. „ „ „ 220 „ 520 „
One 30-H.P. „ „ „ 220 „ 670 „
One 25-H.P. „ „ „ 220 „ 700 „
One 20-H.P. „ „ „ 220 „ 800 „
With rails and pulleys.

ROBERT WALKER,
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Glasgow. 2287

ELECTRIC MOTORS.

SALE or Hire. Second-hand Machines in Stock. ARMATURES and Coils repaired at shortest notice.

THE TITAN ELECTRICAL CO.,
9/11, Eagle Street, W.C.
'Phone: Central 13,191.

CUNNINGHAM, LIMITED.

SMALL Motors and up to 300 H.P. rewound and repaired.

Estimates free. 171, Edgware Road,
'Phone: "5173 Padd." London, W. 2.

(*Continued on next page.*)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

ONE Generating Set Comprising :—
"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m. ; built in 1910, and in first-class order.
Specification and print on request.
THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

MACHINERY FOR SALE.

ONE 50-KW. Browett-Silvertown Generating Set, 500 volts, D.C.
One 62-KW. Mirrlees Watson-Bruce Peebles Generating Set, 500 volts, D.C.
One 150-KW. Belliss-Silvertown Generating Set, 220 volts, D.C.
One 150-KW, Browett-Mavor & Coulson Generating Set, 250 volts, D.C.
Two 150-KW. Belliss-Bruce Peebles Generating Set, 500 volts, D.C.
One 220-KW. Belliss-Silvertown Generating Set, 500 volts, D.C.
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A.C. Motors, 2-phase, 200 v., 50 ~, 2, 4, 6, 7½, 15, 20, 25, 30, 50, 60 H.P. ; single-phase Motors, ½/10 H.P., 100/200 v. ; several 190-H.P., 3-phase Motors, 500 v., 50 ~ ; Motors, several, 30, 35, 50, 60, 100 H.P., 3-phase, 50 ~, 400/440-v., cheap.—5363, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ALTERNATING Motors for Sale, ¼ and ½ H.P. Particulars on application.—BRITISH VACUUM CLEANER CO., Parson's Green Lane, Fulham. 2339

BABCOCK & Wilcox Boilers, two, each 11,000 lbs. evaporative capacity. 200 lbs. steam pressure ; excellent order ; available immediately.—Full particulars from 5346, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOR SALE.—*Continued.*

D.C. Starters, to 150 H.P., in all sizes ; Shunt Regulators, Voltmeters, Ammeters, Ohmmeter and Generator, 500 v. Slide Potentiometer ; ½-H.P., 200-v., 100 ~, single-phase Motor, £8 10s. ; brand new enclosed ½-H.P., 230-v. Motor, shunt, £10 10s. —5365, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOR Sale, Electrolytic Dynamo, 2500 amperes, 60 volts, 300 R.P.M., 8-pole, double commutator type.—PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2327

FOR Sale, H.T. A.C. Switches and Fuses, Static Glowers, 24-point Battery Regulators, D.C. Reverse Current Breakers, Field Regulators, Change-over Switches, Ammeters, and Paralleling Voltmeters, Wheatstone Bridge and Galvanometer, Bostock Folding Gate, 7" Opal Shades, Switch Fuse Contacts and Bolts, Slate Panels, short lengths, 37/16's.—5335, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Modern 300 and 450-KW., 240-volt, direct-coupled Generating Sets for 150 lbs. steam pressure. — PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2328

FOR Sale, Oil Engine, equal new, 17 B.H.P. Dynamo, 100/135-volt, 70 amps. ; slide rails and regulator, main switchboard. £170.—5337, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, second-hand, 105-volt, 200-amp., 800-R.P.M., compound, bi-polar, Crompton Generator.—NEALE & FREUND, LTD., 31, Budge Row, E.C. 2369

FOR Sale, Ship Lighting Set, Robey engine, coupled to 4-pole, compound generator, 60 volts, 160 amperes. Equal to new. £150.—PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2325

FOR Sale, 5-H.P. Oil Engine, in first-class condition.—ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2381

FOR Sale, 15-H.P., 400-volt, 50-period, 3-phase Motor, with spur reduction gear having a ratio of 4 to 1.—PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2329

FOR Sale, 57½-KW., 110-volt, 600 R.P.M., Interpole Generator, by Westinghouse, 1914.—PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2326

GENERATOR, G.E.C., 55/65 volts, 240 amps., 1200 R.P.M., 4-pole interpole.—MARTINS, 320, Witton Road, Birmingham. 5325

MOTORS for Sale : one 2-H.P., B.T.H. ; one 3-H.P. (Bull) ; one 4-H.P (Woolnough), all 220 volts.—Particulars from MANN, EGERTON & Co., LTD., 23, King Street, Norwich. 5344

OFFER.—Two Westinghouse Transformers : One 40-KW., 500/224-volt, 3-phase, 50-period, oil-cooled fitted, voltage regulator, No. B102,355/25,151 ; 1-KW. ditto, No. B102,356/25,153. One 2-H.P. Westinghouse S. C., 230-volt, 3-phase, 50-period motor, No. 127,244. Also about 600 electric filament globes, in perfect condition. Await best offers.—THOS. HORTON, Merthyr. 5313

ONE 13-H.P., 440-v., shunt, interpole crane-rated Motor, 900 R.P.M., by Phœnix.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5378

(Continued on next page.)

FOR SALE.—*Continued.*

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

ONE 400-V., 8-H.P., 600 R.P.M., totally enclosed, series-wound, crane-rated Motor, by Lancashire Dynamo Co.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5377

PETROL Set, 70 v., 80 a., Crypto; Motor-Generator, 220 v. to 70 v., 80 a.; ditto, 480 v. to 60 v., 80 a.; ditto, 440 v., 2-phase, 50 ~, to 100 v., 20 a.; ditto, 220 v., single-phase, 50/60 ~, to 60 v., 60 a.; ditto, 110 v., 60 ~, single-phase, to 85 v., 35 a.; ditto, 100/200 v., single-phase, to 60 v., 10 a. Cheap.—5367, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE 8-H.P., 220-volt, brand new, shunt-protected Motors, 1600 revs.; just unpacked.—DRUMMOND & Co., Middlesbrough. 5305

TWO 250-KW. Belliss Alternator Sets, each comprising a Compound Enclosed Engine, with E.C.C. Alternator, 3000 volts, 50 periods; quite modern, and for immediate delivery.—HARRY H. GARDAM & Co., LTD., Staines. 1852

1 AND ½, A.C. and D.C. Motors, 110 v. and 220 v., D.C., 110 v. and 220 v., A.C., 40, 50 and 60 periods.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5373

2-POLE Overtype Generator, 280 v., 40 amps. With spare armature and shunt regulator.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5374

5-H.P., 220-v., 1200 R.P.M., by Electromotors, with starter and pulley.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5376

6-H.P., 500-v. B.T.H. Motor, 1200 R.P.M., with starter, pulley and rails.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5375

25-H.P., 3-phase slip-ring Motor, by Siemens, 440 volts, 60 cycles, with short-circuiting device; also complete starting gear.—DRUMMOND & Co., Middlesbrough. 5308

44-KW., 110-volt D.C. Generator, compound wound, three-bearing type, with rope pulley and slide rails; speed, 600.—DRUMMOND & Co., Middlesbrough. 5306

55 "C.H." 11-plate Cells, by E.P.S., in good order. Price £160 net, as now fixed at Gt. Chesterford, Essex.—Apply BAILY, GRUNDY & BARRETT, LTD., Cambridge. 2357

70-B.H.P. Lancashire D.C. Motor, 500 volts, 500 R.P.M., equal to new; 5-B.H.P. Electric Motor, 110 volts, D.C.; slow-speed Dynamo, 25/37 volts, 60 amps., 370 R.P.M.—STANLEY ENGINEERING Co., Bath. 2310

100-KW., 220/240-volt, 6-pole Generator, compound interpole 3-boring type. Perfect order. — DRUMMOND & Co., Middlesbrough. 5307

100-V. Motors and Dynamos, 1, 2, 3 and 9 H.P., with starters and pulleys.—H. RYAN, 121, Middlesex Street, London, E.C. 1. 5372

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery.—HARRY H. GARDAM & Co., LTD., Staines. 1851

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ARTICLES WANTED.

WANTED IMMEDIATELY, FOR CASH.

COMBINED Petrol or Paraffin Engine and Dynamo; direct-coupled preferred, approximately 100 v., 80—100 amps. Apply—
THE DARLINGTON MOTOR & ELECTRICAL Co.,
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ARTICLES WANTED.—*Continued.*

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A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 4765

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 4766

A1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

DYNAMO wanted, must be modern type, volts 100, amps. 150.—Full particulars and price to GOLDSTON, Marefair, Northampton. 5356

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 5158

NEW or Second-hand Tubing and Fittings wanted.—WALLACE, 58, High Street, Bloomsbury. 2307

OLD Cable urgently required, also Lamp Tops.—WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps that have had wire-drawn tungsten filaments in them with glass parts intact, 1½d. each, any make.—104, Craven Park, London, N.W. 10. 5049

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

ONE 5 or 6-H.P., 3-phase Motor, 200 volts, 50 periods.—BAILY, GRUNDY & BARRETT, LTD., Cambridge. 2356

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

SECOND-hand Plating Dynamo required, 6 volts, 2000/3000 amperes.—2352, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SMALL Complete Lighting Set required, with engine, dynamo, accumulators, &c.; also extra set, small accumulators, and some old plates.—2349, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Battery, 54 cells, 230 ampere-hours capacity, shunt-wound Generator, 140 to 145 volts, 22 amps., for accumulator charging.—W. A. MEADOWS & Co., LTD., Percy Street, Hanley, Staffs. 5243

WANTED, Direct-Coupled Steam Set, any output from 50/100 KW., will be considered; 440/480 volts, D.C.—State full details, price and where seen, to 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, direct-coupled Steam Set, 50 to 70 KW., 220 volts, compound, D.C., steam pressure 150 lbs., engine high speed, vertical, complete with all accessories, and must be first-class. Belliss set much preferred. State makers, date, condition, where seen, and price f.o.r.—5333, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

WANTED, Electric Cooking and Heating Apparatus, Kettles, Irons, Vacuum Cleaners, all voltages. Also Electric Bells, Lamps and Arc Lamp Carbons, and all classes of Accessories and Flexibles. — Fullest particulars to 2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export: also Scrap Cable and Metals, Complete plants purchased.—WILLIAMS & SONS 37, Queen Victoria Street, London. Telephone: 3938 City. 7000

WANTED, Motor-generator, comprising 200-volt, 50-cycle, single-phase Motor, coupled to 70-volt, 80-amp. Dynamo; also one ditto, 440 volts, D.C.—R. F. WINDER, Cross Belgrave Street, Leeds. 2360

WANTED, one compound high-speed vertical Steam Engine direct coupled to D.C. Generator, 220-volt; engine to be suitable for steam pressure 110 to 150 lb.; output required, 50 to 60 KW. Set must be complete with all accessories, and absolutely first-class condition and make. State maker, date and full particulars of plant, also price f.o.r. — 5281, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one 120-H.P., A.C., 500-volt, three-phase, 50-cycle Motor, 750 R.P.M.—MCWHIRTER & SON (CARDIFF), LTD., Cardiff. 2364

WANTED, one 600/800-amp., 50/60-volt D.C. Generator. Also one 600/800-amp., 50/60-volt, single-phase Alternator, 50 periods, with exciter.—JOHNSON, MATTHEY & CO., LTD., Hatton Garden, London, E.C. 1. 2297

WANTED, Shunt Dynamo, 50/70-volt, 20-25 amps. Regulator and slide rails Switchboard, suit 27 cells.—5338, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, single-phase 100-cycle Motor, 4 to 5-H P., 100 or 200 volts, 1,400/1,800-R.P.M.—State make, condition and price, to BOROUGH ELECTRICAL ENGINEER, Municipal Offices, Cheltenham. 5359

WANTED, Thomas Parker overtype Dynamos, any size or voltage. Cheap.—WILLIAM TAYLOR, Grosvenor Road, Southport. 5370

WANTED, two A.C. Motors, 110 volts, 60 periodicity, 20/30 H.P., single phase. — Particulars to CRYSELCO LIMITED, Kempston Works, Bedford. 1826

10 TONS old Transformer or Armature Stampings wanted.—Particulars to 5296, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

25-H.P., 220-v. D.C. Motor; 30-H.P. ditto; 3-H.P., 1400 R.P.M., 220 or 440-volt D.C. Motor; 15-H.P., 210-volt, 83-period single-phase Motor; direct-coupled Steam Set, dynamo 7 to 12 KW. 220 volts D.C., working steam pressure 90 lbs., or vertical Steam Engine only, to drive 12½KW. dynamo, steam pressure 90 lbs.—WILLIAMSON, 104, Peckham Rye, London, S.E. 15. 5349

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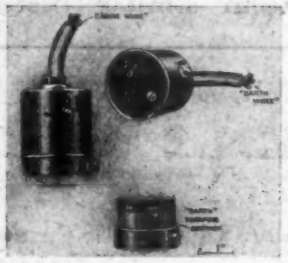

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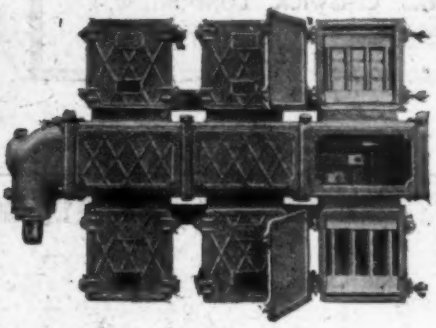

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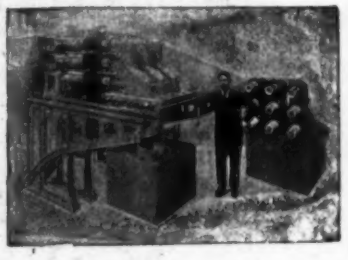

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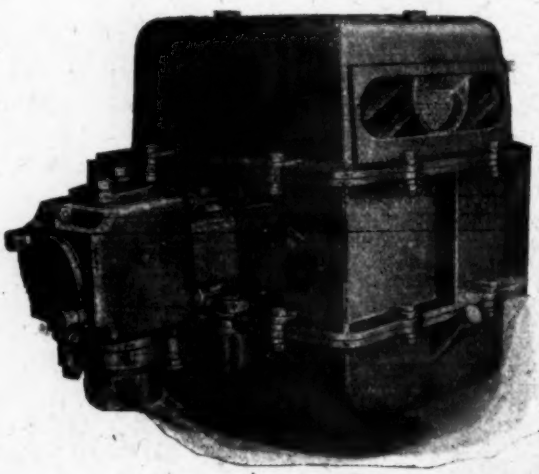

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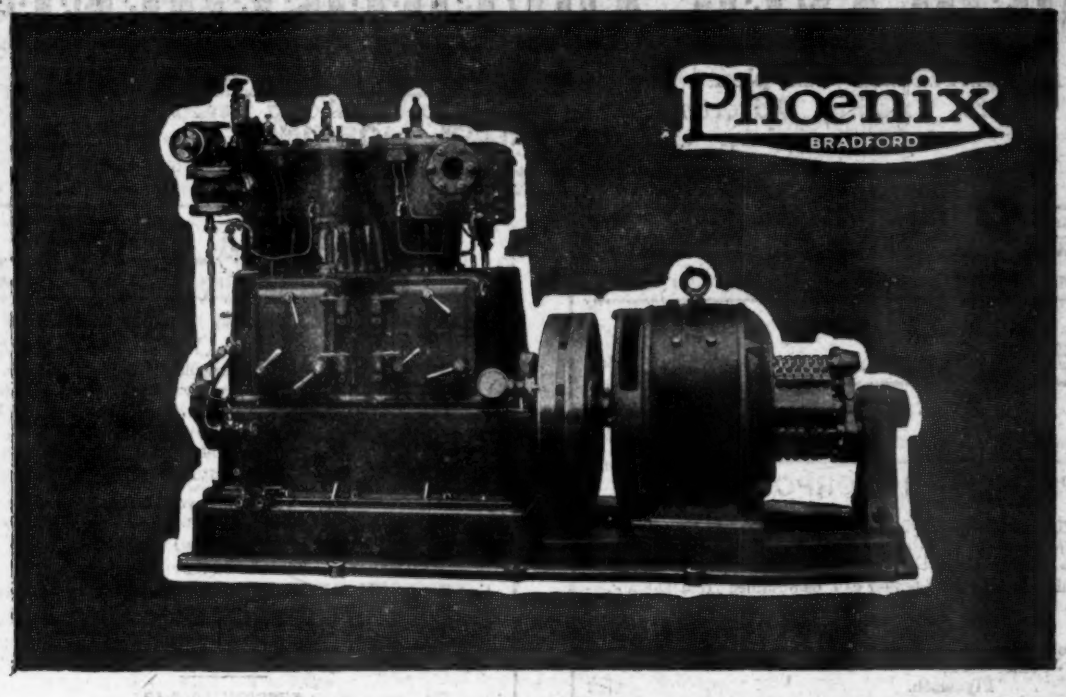

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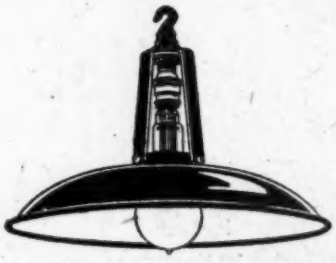

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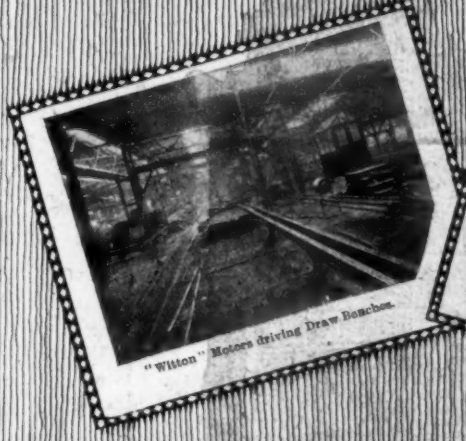

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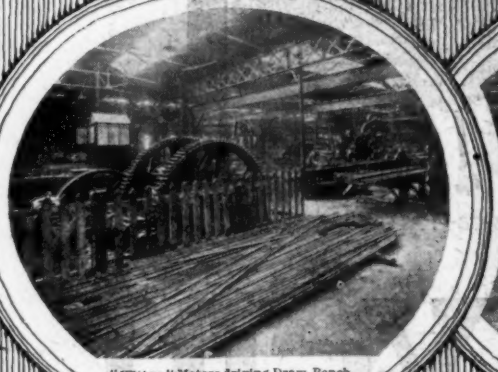

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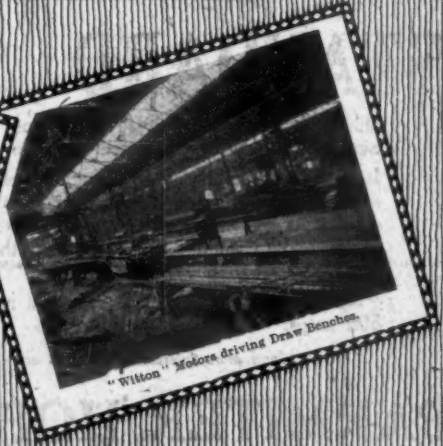

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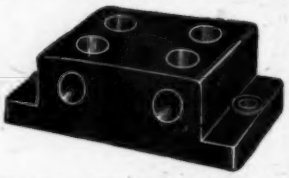

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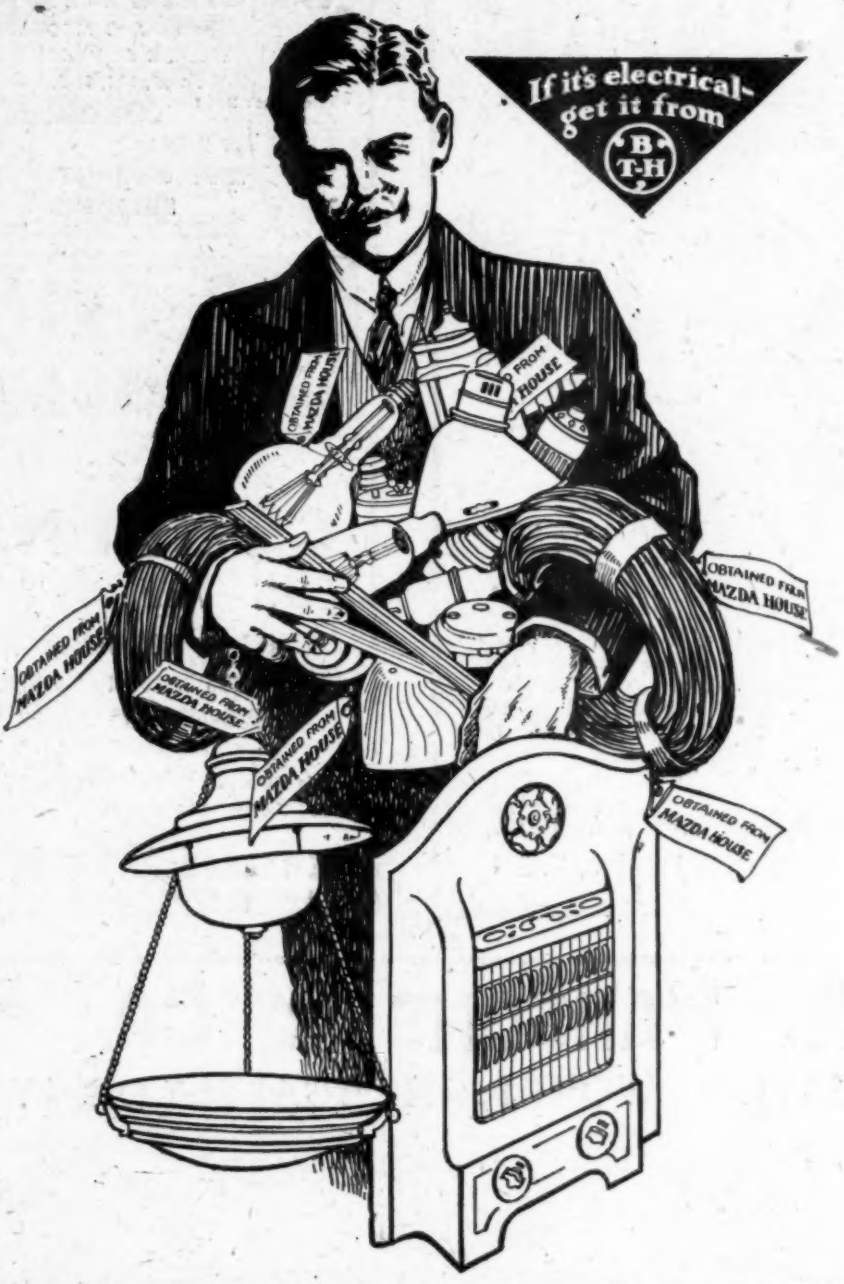

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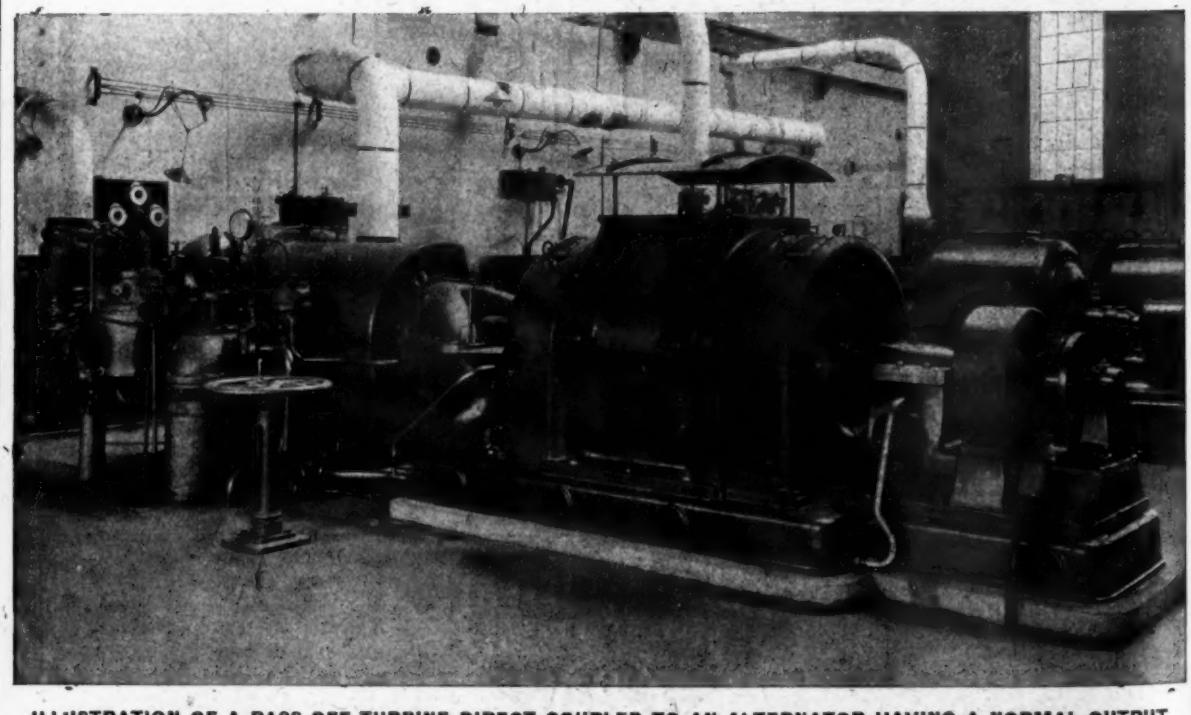

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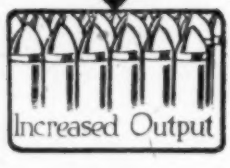

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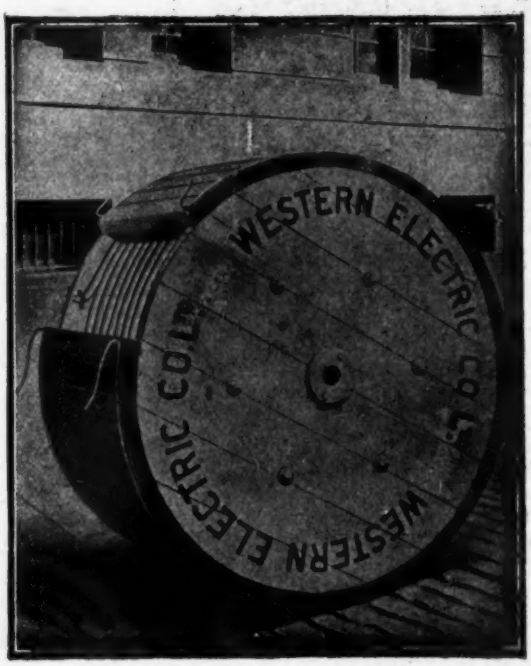

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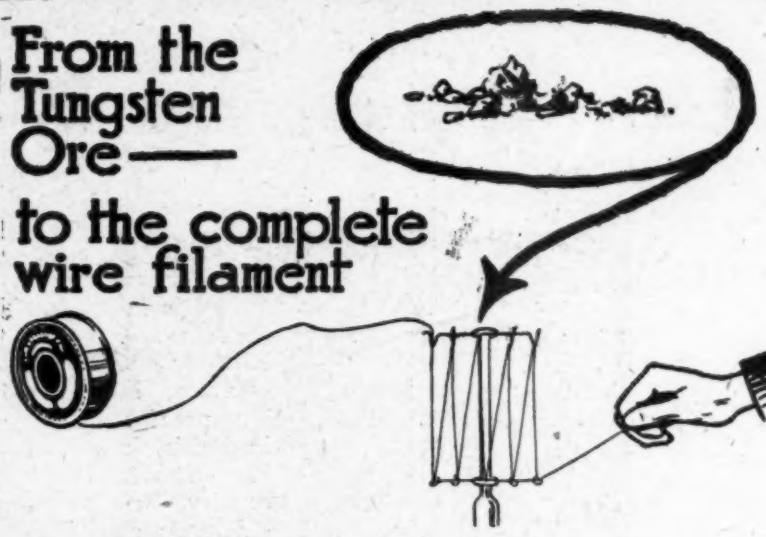

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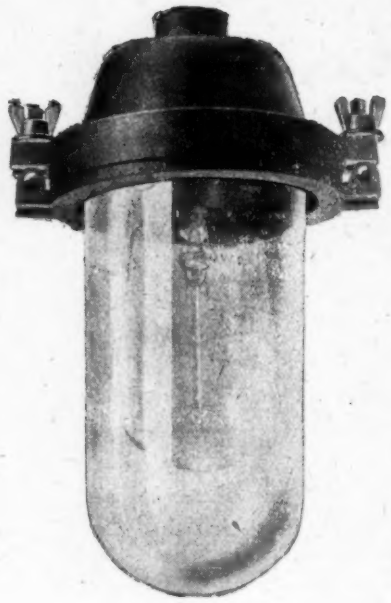

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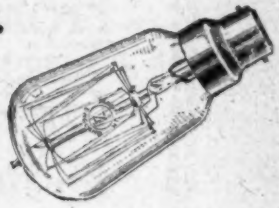

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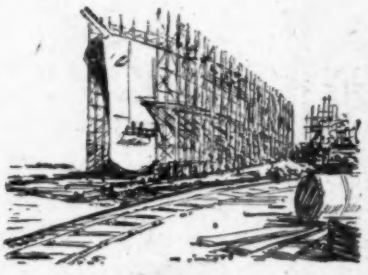

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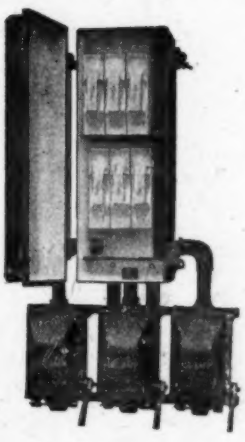

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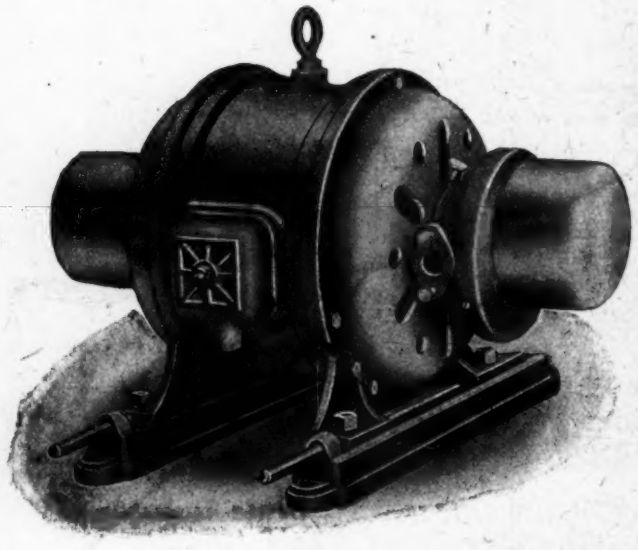

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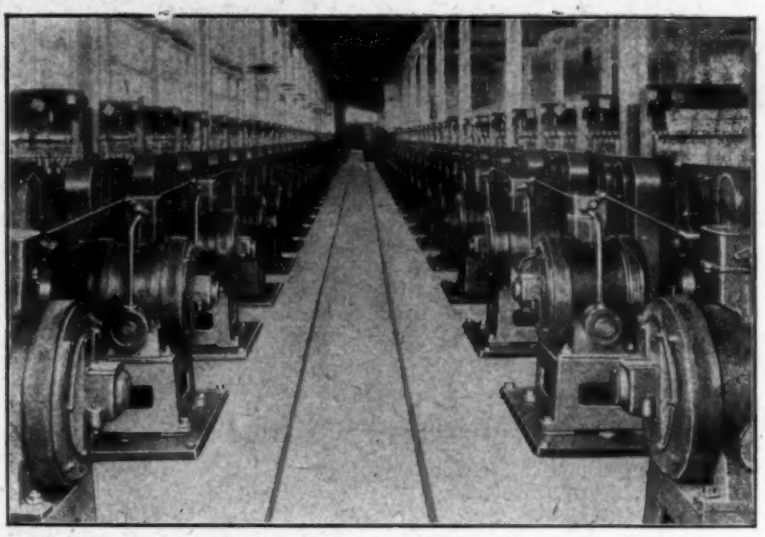

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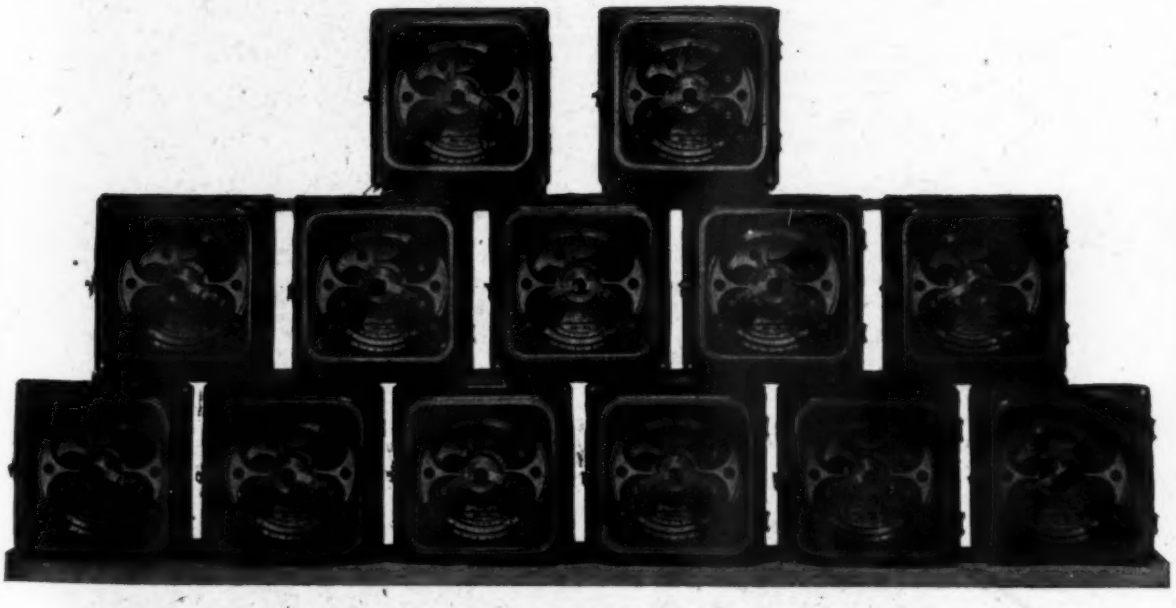

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Glasgow.—Year's Working.—The annual report of the Corporation electricity undertaking for the year ending May 31st shows a gross revenue of £789,002, compared with £580,412 last year, and working expenses of £542,717, against £404,404, out of which was met interest on loans £92,454 and sinking fund £86,551, leaving a balance on the year's working of £67,280, against £16,940 last year. After various deductions there was a surplus on the year's operations of £7,146, against a deficit last year of £38,667, which has been transferred to the reserve fund. Allowances granted to employés on Active Service reached £10,843. The capital expenditure amounted to £297,834. The average price received from consumers was 1·207d. per unit, against 0·975d. for the previous year; working cost per unit was 0·748d., against 0·602d. The number of consumers was 35,724, an increase of 775; units sold were 154,472,277, an increase of 13,958,597 (lighting, 22,085,527 units; power and heating, 132,386,750 units). The total number of motors in use was 12,904 against 12,401, of a total H.P. of 105,739 against 97,733, and consuming 129,456,525 units against 117,547,855 units last year. The total maximum demand connected to the mains was 132,316 KW., an increase of 9,136 KW., and the maximum demand made upon the stations was 55,610 KW., an increase of 6,425 KW. on last year. During the year the following alterations and additions have been made:—At Port Dundas a third 8,000-H.P. turbo-alternator was put into commission, and a fourth 8,000-H.P. set by Dick, Kerr & Co. has been purchased, and is expected to be on load this year. Two old sets are being removed to make room, and the capacity of the station will then be 48,160 H.P. Underfeed stokers, with forced draught and a new steel chimney, with induced draught, have been fitted to four boilers. Two 1,000-KW. B.T.H. rotary-converters have been installed in the sub-station, the capacity of which is now 4,000 KW., and the erection of a 20,000-volt sub-station to form a connecting link between Port Dundas and Dalmarnock stations is being proceeded with. At Pollokshaws Road the 8,000-H.P. Willans turbo-alternator is now in regular service, the capacity of this station being 33,120 H.P. Two small generating sets have been removed to make room for two 1,500-KW. Bruce Peebles rotary-converters, and a 20,000-volt sub-station is being erected in this station, the switchgear of which is complete. The grate areas of the large boilers have been increased, and a new induced draught fan installed, and a new bucket conveyor has been installed to relieve the overloaded coal conveyor. A 1,000-KW. B.T.H. rotary-converter has been installed in, and a similar set has been ordered for, both the Govan and Partick stations; their capacities will then be 3,750 and 2,750 KW. respectively of converting plant. There is no change in the generating plant, and the steam plant at Partick was only run during the winter months. At Yorkhill a 500-KW. Bruce Peebles rotary-converter has been installed in place of a 250-KW. set removed to another sub-station. The transformer sub-stations on consumers' premises now number 42, being an increase of four, and a further 18 are in progress. Steady progress has been made with the building of the new Dalmarnock works, and orders have been placed for two additional 15,000-KW. turbo-alternators, making four in all. During the year ½ mile of L.T. feeders and 6¼ miles of H.T. feeders, in addition to 1¼ miles of distributors, were laid on the north side of the river, and 2 miles of L.T. feeders and 6¼ miles of H.T. feeders, in addition to 1 mile of distributors, were laid on the south side of the river.

Harrogate.—National Electricity Supply.—The T.C. has protested against the Government proposals to take over electricity generating stations, and has decided to oppose any Bill introduced for this purpose.

King's Lynn.—Year's Working.—The Electricity Committee has reported that the total revenue of the undertaking for the year ended March 31st last was £12,227, against £8,759 in the previous year. The gross profit was £4,820, against £3,032, and, after payment of interest and instalments on loans, the net profit was £2,146, against £290. This is the best year the undertaking has had. The expenditure on capital account was £1,127, bringing the total to £59,483. The balance standing to the credit of the net revenue account was £2,639, of which £1,035 was used to pay off outstanding liabilities on capital account, and £1,604 carried forward to next year's accounts.

Price Increase.—The Committee recommended that the price of energy for lighting and power purposes be increased by ½d. per unit, and this was referred back for consideration as to whether there should be any differentiation between lighting and power.

Linthwaite.—Proposed E.L.—At a meeting, last week, the Council declined to pass the account of the local gas company, which was held to be excessive, and it was suggested that Colne Valley was behind the times in not having an electric lighting system. The question of installing electric light is to be considered at the next meeting of the Council.

Nenagh (Co. Tipperary).—Proposed E.L.—The Gas Consumers' Co. has decided to install an electric lighting plant.

New Zealand.—Hydro-Electric Scheme.—A deputation of the local Industrial Association has approached the Auckland City Council on the question of the advantages of a hydro-electric scheme. The deputation pointed out that it would be in the interests of the Council and the industrial development of the city to take its supply of electricity from the Government, and use the existing plant as a reserve.

Sheffield.—Mains Extensions.—The Corporation has decided to lay an E.H.T. cable between Neepsend power station and Renton Street sub-station, a distance of 5,340 yards, at an estimated cost of £10,584. Land and buildings opposite Lambert Street are to be taken over as a site for a sub-station.

Subject to the approval of the Finance Consultative Committee, the Corporation has sanctioned the expenditure of £700,000 for the purchase of turbo-alternators, boilers, &c., for the electricity department.

Stoke-on-Trent.—Loan Sanction.—The necessary consent has been received to the borrowing of £7,340 for laying an L.T., D.C. feeder from Bagnall Street sub-station to Holtshill.

Tonbridge.—Price Increase.—The U.D.C. has decided to increase the charges for electricity by which the revenue from the general supply will be increased by £390, and for large consumers by £610.

Warrington.—Price Increase.—The E.L. Committee has increased the charges for electricity by 5 per cent. for lighting and by 10 per cent. for power (other than for tramway purposes) from September 30th next.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Year's Working.—The annual report of the Corporation tramway undertaking states that the revenue for the year ending May 31st, 1918, was £116,397, or £16,324 more than in the previous year, while the expenditure amounted to £76,997, an increase of £12,971. Capital charges accounted for £27,188, and £8,141 was added to the reserve fund, leaving a net profit of £4,070. The car-miles run numbered 2,172,792, an increase of 307,220. The average price paid for energy, which increased by 32 per cent. from February 12th, was ·917d. per unit, against ·839d., and the energy consumption per car-mile was 1·312 units, against 1·251.

Ashton-under-Lyne.—Extensions.—In view of the purchase of the undertaking of the Oldham, Ashton, and Hyde Electric Tramways Co., the Corporation has completed arrangements for large extensions to its existing car shed, and has purchased land for further extensions.

Burnley.—Threatened Strike.—Owing to the dismissal of several employés of the tramways department, the remainder handed in their notices last week. The notices have now been withdrawn, and a meeting of the Tramways Committee and the men's Unions has been arranged to discuss the matter.

Canada.—Strike.—The employés of the Ottawa tramways struck work last week for an increase of wages; an offer by the company to put the matter before the Federal Labour Board was refused.

Chile.—Proposed Electric Railway.—The Ministry of the Interior has postponed the construction of an electric railway between Vina del Mar and Concon until one year after the end of the war, and between Vina del Mar and the River Aconcagua until two years after the end of the war.—*B. of T. Journal.*

Continental.—Swiss Electrification Scheme.—The general management of the Swiss Federal Railways has submitted to the Council of Administration a scheme providing for the introduction of electric traction. It is proposed that the programme shall be completed in 30 years, in three sections, at a total cost of from 3,000,000,000 to 4,000,0000,000 fr. Three-quarters of the electric power is already assured, whilst the remainder will be provided by future concessions.—*Financier.*

Germany.—An extensive network of electric railways is planned for the industrial district of Merseburg, where recently very important industries have been established, including a large factory for ammonia for use in making artificial nitrates. The length of the railway lines is to be 68 kilometres, and the cost of construction is estimated at 10,000,000 marks. A new company will be established with a capital of 2,500,000 marks, of which the A.E.G. subscribes 1,000,000 marks, leaving it principally to the municipalities interested to raise the remainder.

France.—It is reported that an aeroplane alighting in Marseilles owing to engine trouble, struck the tramway trolley wires, resulting in two cars which were approaching being set on fire. Four passengers were killed and several injured, while the two aviators were seriously burned.—*Pall Mall Gazette.*

Electric Vehicle Progress.—Burnley Electricity Committee is considering the purchase of an electric vehicle.

Glasgow Corporation Cleansing Committee recommends that for the collection of refuse four additional electric vehicles be purchased, at a cost of £5,200.

Maidstone T.C. has received sanction to purchase a 3½-ton electric tipping wagon, at a cost of £1,200.

Huddersfield.—Service Reduction.—A recommendation of the Tramways Committee for the reduction of the tramway services every day was defeated by one of the General Purposes Committee for the total stoppage of the cars on Sundays. This is subject to confirmation by the Council.

London.—Collision.—An L.C.C. tramcar and a steam lorrey collided at Stockwell, on Friday morning last week, considerably damaging the front of the car. The driver, a discharged soldier, was rendered unconscious, and four passengers had to be conveyed to hospital.

STRIKE.—A strike of tramway and 'bus conductresses on Saturday brought nearly all the omnibus services and a large part of the tramway services to a stop. Conferences were held to deal with the points at issue—the claim of the women workers to equal pay and bonuses with the men for equal work. Most of the L.C.C. conductresses are members of a Union, which asked its members to remain at work pending the result of the conferences. The strike began on the L.U.T. system in support of a demand for the 5s. bonus recently awarded to the men workers by the Committee on Production, and the Provincial Union of Licensed Vehicle Workers approved the action, and called on all its members to cease work. In consequence, the strike extended to all the omnibus and tramway systems, excepting the L.C.C. and the M.E.T., which were kept running; a number of their conductresses who are members of the Union ceased work, however. The London United, Croydon Corporation, and the South Metropolitan services were entirely suspended. At a mass meeting of the strikers the action of the Vehicle Workers' Union was approved, and it was resolved to call out the members of the Union throughout the provinces on Monday morning. The meeting pledged the members not to return to work until the women's demands were satisfied and the strikers reinstated. It was stated that the majority of the L.C.C. employés were not prepared to strike. The Amalgamated Association of Tramway and Vehicle Workers' Union posted notices in the depôts on Sunday telling its members, in their own interests, not to cease work pending the conference which the representatives of the employers and workers were to have with Sir George Askwith on Monday. A conference of the Unions took place on Wednesday under the auspices of the Transport Workers' Federation. As a result of the strike, there was much overcrowding on the Underground Railways.

The 5s. is equivalent to the 12½ per cent. grant made to the men. It was not extended to the women, and in no trade in the country have the women received this 12½ per cent. grant. If the 'bus and tramway girls succeed in getting this 12½ per cent. equivalent, it will be the thin edge of the wedge for women in all trades all over the country, and will cost the Government millions of pounds. The assistant secretary of the Transport Workers' Federation stated that the average wage for a 'bus driver was £4 per week, and therefore 12½ per cent. would be 10s. The Committee on Production awarded the men 5s., and if it gave the women the 5s. for which they asked, that would then make the total award equivalent to 12½ per cent.; the men would be satisfied if the women got the 5s. balance on the 10s., and a settlement would be reached.

The trouble spread to the provinces, and on Monday the services at Hastings, Hove, Worthing, Brighton, Bath, Bristol, Folkestone, and Weston-super-Mare were disorganised. During the day meetings took place between Sir Geo. Askwith, the employers, and the Union officials, but no settlement was arrived at.

A number of women platform attendants on the Bakerloo Railway struck work on Monday in sympathy with the tramway workers. Apparently the girls have a grievance of their own; after a short meeting it was declared that they were getting 12s. 6d. per week less than the men, although working the same hours.

Manchester.—RAILWAY ACCIDENT.—A heavily laden electric passenger train, instead of slowing down, so it is alleged, accelerated its speed as it entered Victoria Station, and crashed into the hydraulic buffers. Twenty-nine persons were injured.

Monte Video.—STRIKE.—The strike of the tramway employés continues, although men in other industries have resumed work. Last week the police discovered a plot to assassinate the manager of the tramway company; police and troops were bivouacked in the streets to preserve order.

New Zealand.—ELECTRIC VEHICLES.—It is stated that electric vehicles garaged by the Christchurch City Council have their electrical equipment kept in repair and batteries charged for £35 per annum. In one factory, where 49 H.P. is used, the average monthly cost is from £8 10s. to £8 15s., against £32 per month for steam for 58 H.P.

Rochdale.—FARE REVISION.—In place of a general advance of fares, the Tramways Committee proposes to institute a war tax on fares, and has applied to the B. of T. for permission. The proposed tax is as follows:—½d. on 1d., 1½d., and 2d. tickets, 1d. on 2½d., 3d., and 3½d. tickets, and 2d. on 5d. and 6d. tickets.

Sheffield.—ELECTRIC TOWER WAGON.—The Tramways Department is to purchase an electric vehicle chassis for use as a tower wagon.

LINKING-UP.—The linking-up of Sheffield and Chesterfield—12 miles—by tramway is being arranged, the Sheffield Corporation having entered into an agreement with the Chesterfield R.D.C. to construct a tramway to Dronfield.

Southport.—EXTENSION OF TIME.—The B. of T. has extended the time for the completion of the electrical equipment and apparatus for the working of trolley vehicles, on the route authorised, for one year from August, 1918.

Saving Tramway Power.—According to the *Electric Railway Journal* the Connecticut Co. has tackled the problem of the education of its employés, to the number of 2,500 drivers and conductors, running 1,100 passenger cars, resulting in an 11 per cent. reduction of power in five months; in a demonstration it was shown that an ideally-operated car absorbed from 25 to 32·5 per cent. less energy than one operated on the same route by the average motorman's method. Economy in fuel may be made in many ways by the application of a little intelligence and very little sacrifice in convenience. For example, notices in the cars call for the warning to the driver to stop to be given in good time, to enable him to coast along to a stop with the final minimum application of brakes, rather than by a sudden stop, with consequent wear on brake-shoes and wheels and loss of the stored momentum in the moving car. The saving of a few seconds at each stop would, within the time allowed for the journey, permit of more coasting in stopping, with the resultant saving of energy. Again, a maximum of energy is required to start up a car, the energy thus used being estimated to be equal to that required to run a quarter of a mile on the level. Economy in many directions can be effected. To realise this, both driver and conductor need to be impressed with the importance of the saving which can thus be made.

Tramway Undertakings and Coal Rationing.—A conference of tramway undertakings and electrical engineers was held at Manchester last week, when discussion took place on the question of tramway economy, as relating to the order requiring tramway authorities to reduce their consumption of electricity by 25 per cent. The opinion was expressed by those present that whilst they were anxious to help the B. of T. in every way and to conserve fuel, they thought it was unfair that the tramway authorities should be singled out for the rationing of coal. It was suggested that whatever action might be taken, nothing should be done until there was a general rationing in all industries.

Yarmouth.—STRIKE.—After lasting three days the strike of the tramway employés came to an end on Monday, work being resumed on the Corporation conceding an advance in wages of 7s. per week, making 20s. increase on pre-war rates.

TELEGRAPH AND TELEPHONE NOTES.

American Marconi Decision.—Under a legal decision in the New Jersey Courts, the Marconi Wireless Telegraph Co. of America is held liable for royalties to the International Signal Co. in respect of certain transactions. The amount was not in dispute, but merely the obligation to pay it. The sum, however, is considerable, approximating £600,000.—*Financial Times.*

Australia.—At Melbourne City Court, on June 14th, Sydney Paul Morris, formerly employed as wireless operator by the Defence Department, was charged with having been found in possession of an official wireless telegraph manual and other confidential documents. After evidence had been given, the accused was committed for trial before the Supreme Court in July.

At the Malvern Police Court J. W. T. Rowe was fined 40s., and £4 6s. 6d. costs, for having in his possession instruments connected with the sending or receiving of messages by wireless telegraphy.—*Melbourne Age.*

Hungary.—Telegraph and telephone communication between Budapest and Northern Hungary has been interrupted as the result of the explosion of a petroleum train at the station of Erlau, in Hungary.

New Zealand.—Sir Joseph Ward, the Postmaster-General, referring to the future development of the telephone system in New Zealand, has indicated that as soon as possible after the war there will be a development of the automatic system which will practically mean the elimination of the exchanges in some of the more important districts, and enable continuous service to be carried on independently of operators. When the price of copper wire permits they will have a telephone service which will connect every town in the North Island with every town in the South Island.—*Sydney Sun.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" to-day.

Spain.—The municipal authorities of Villarramiel (Province of Valencia) recently invited tenders for the concession for the electric lighting of the town during a period of four years.

CLOSED.

Australia.—MELBOURNE.—Electricity Committee recommended:—

1,600 500-watt, gas filled metal filament lamps	£1,300
400 800-watt, ditto	275
2,500 50-C.P., 230 volts, ditto	219
7,500 ditto, 200 volts, ditto	612
500 100-C.P., gas filled, ditto	197

Australian General Electric Co.

P.M.G.'s Department, N.S.W.:—

3 10-H.P. motors, 480 volts D.C., £264.—T. M. Goodall & Co., Ltd.

—*Tenders.*

Cape Town.—City Council. Messrs. E. A. Shaw & Co. Extension of the electric lighting at the City Council, £276.

Colchester.—T.C. Engines and dynamos. Davey, Paxman and Co., Ltd., and Crompton & Co., Ltd.

Government Contracts.—Placed July, 1918 :—

War Office.

X-ray apparatus.—Johnson & Sons.
Electric cables.—General Electric Co., Ltd.; Western Electric Co., Ltd.
Dynamos, &c.—Tilling, Stevens, Ltd.
Fans, &c.—Davidson & Co., Ltd.; J. Keith, Blackman & Co., Ltd.; Sturtevant Engineering Co., Ltd.
Generating sets.—Bellis & Morcom, Ltd.; H. T. Boothroyd, Ltd.; Brown, Lindley & Co., Ltd.; Buffalo Forge Co., Ltd.; Equipment and Engineering Co., Ltd.; General Electric Co., Ltd.; H. Green & Co.; R. A. Lister & Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.
Motors, &c.—Maudsley's, Ltd.
Transformers.—Foster Engineering Co., Ltd.
Works services: Electrical.—Dargue, Griffiths & Co., Ltd.; Northern Electrical Ventilating Co., Ltd.
Iron wire, &c.—R. Johnson & Nephew, Ltd.; J. Pring & Sons; Rylands Bros., Ltd.; Whitecross Co., Ltd.

H.M. Office of Works.

Engineering works.—National Physical Laboratory, Teddington.—High-tension switch panels, Ferguson, Pailin & Co., Ltd.; ditto, electric supply cables, Siemens Bros. & Co., Ltd.

Post Office.

Protective apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Arm bolts.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; C. Richards and Sons, Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraphic and telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Ducts.—Albion Clay Co., Ltd.
Telephone earpieces.—Siemens Bros. & Co., Ltd.
Cable distribution plugs.—British Insulated & Helsby Cables, Ltd.
Telephone plugs.—British L. M. Ericsson Manufacturing Co., Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.
Stay swivels.—Bullers, Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd.
Voltoids.—Brunner, Mond & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.
Bronze insulated wire.—Siemens Bros. & Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.
V.I.R. wire.—Johnson & Phillips, Ltd.

India Office (Stores Department).

Crucibles.—Morgan Crucible Co.
Telephone sets.—Peel-Conner Telephone Works.
Wire.—Callender's Cable Co., Ltd.; Shropshire Iron Co.; R. Johnson and Nephew, Ltd.

NOTES.

Mineral Output of the United Kingdom in 1917.—Part I of the annual general Report on Mines and Quarries has now been issued for the year 1917. In a preliminary report previously issued details were given as to the mineral output from mines under the Coal Mines and Metalliferous Mines Acts. The present issue includes also that from quarries. The following table shows some of the outputs :—

Mineral.	Total, 1917, in tons.	Inc. or dec. in tons.
Coal	248,499,240	+ 7,876,126
Copper ore and precipitate	1,159·5	+ 131·5
Iron ore	14,845,734	+ 1,351,076
Iron pyrites	8,515	— 1,966
Lead ore	15,322	— 1,785
Lignite	900	+ 400
Manganese ore	9,942	+ 4,802
Oil shale	3,111,658	+ 102,426
Tin ore (dressed)... ...	6,576	— 1,316
Tungsten ores	241	— 153
Uranium ores	13	— 38
Zinc ores	7,484	— 992

Coal Conservation Committee's Report.—The Ministry of Reconstruction has just issued the final Report (Cd. 9,084) of the Coal Conservation Committee, which was appointed to consider and advise as to the improvements which could be effected (1) in the mining of coal, (2) in the using of coal, and (3) in the extension of coal supplies. Five Sub-Section Committees were appointed to deal with different phases of these questions—namely, with mining methods, power generation and transmission, metallurgy, carbonisation, and geology. At a later date the Sub-Committees on Carbonisation and Metallurgy were amalgamated. The Reports of these various Sub-Committees have been approved and adopted by the main Committee, and they are now published along with the final Report in the form of appendices. The Report of the Power Generation and Transmission Committee was published separately early this year, and its recommendation of a national scheme of electrical generation and transmission has attracted wide attention. This Report is reproduced in the final Report, which forms a comprehensive survey of the place of coal in the industries of the future. Considerable attention has been given to the part which the carbonisation of coal is calculated to play in reconstruction, and all known methods of preparation and treatment have received full examination. Steps are suggested not only for making more efficient use of those grades of coal at present burned in a raw state, but also for putting to valuable use inferior coal, shale, and coal dust, now regarded as waste. Another matter of which the Committee emphasises the importance is the necessity of obtaining fuel oils, motor spirit, and the raw materials for explosives, drugs, and dyes. It is considered practically certain that larger supplies can be obtained from coal by the new methods of working which are proposed. The Committee recommends the combined working in groups or units of coke ovens, blast furnaces, steel furnaces, and rolling mills, each unit to have a capacity of from 300,000 to 500,000 tons of finished steel per annum. One of the conditions of success will be the grouping of these united plants in suitable districts. A definite conclusion has been reached regarding the production of electric power on a large scale, and it is felt that there is also a definite field for the use of gas engines of the ordinary type. Research work is in progress with a view to forwarding the design and production of internal-combustion engines. The necessity of replacing old with modern plant, especially in the smaller colliery undertakings, is pointed out as a further means of economising in fuel. The establishment of a Ministry of Mines and Minerals is recommended. It is proposed that, with certain exceptions, those functions connected with the coal-mining industry now vested in various Government Departments shall either at once or after the war be transferred to a Ministry presided over by a Minister with a seat in Parliament. It appears that no fewer than seven Government Departments are now intimately concerned with mines and minerals. It is pointed out that considerable possibilities in connection with the location of new coalfields and the extension of those already being worked lie within the scope of the geological survey now being made. It is possible, the Report shows, that a large increase in our mineral wealth might be found were systematic exploration carried out by this body.

Prohibited French Exports.—Since the commencement of the war, various Orders have been issued by the French Government imposing prohibition on the exportation from the country of certain materials. The *Board of Trade Journal* has just rendered a useful service by publishing a complete list of the Prohibition Orders at present in force in France, from which we have compiled the following list of goods and materials appertaining to the electrical industry :—Electrical apparatus, materials and parts adapted for use in war; dynamo-electric machines; magnetos; accumulators and accumulator plates; electric batteries and their elements; telegraphic apparatus—land, submarine, and wireless; carbons and other electrodes for electrical purposes; carbon brushes for dynamos; cables and insulated wire for electrical purposes; insulating materials other than rubber; electrical insulating compositions and products; ebonite; and vulcanised fibre.

Industrial Reconstruction Council.—In its report for the six months ended June, the Council says that since the date of the last report great progress has been made with the movement towards self-government for industry. There is general recognition on all hands of the need for organisation. Trade Associations are experiencing a great accession of membership, and workers are flocking into their Trade Unions. This strengthening of Associations and Unions is almost entirely due to the belief that joint bodies will be formed. There is no trade that is not discussing, if only in a preliminary or unofficial way, its relation to the Whitley Report, and hardly any trade that has not accepted its underlying principles. The work of the Ministry of Labour in promoting Joint Standing Industrial Councils, and of the Ministry of Reconstruction in connection with Industrial Reconstruction Committees, appears to be reaching out over the whole range of industries, and the prospects of the early establishment of a general joint advisory system for Government purposes seem to be extremely bright. The Council regrets a tendency among employers in certain quarters to restrict the function of joint bodies to what are known as "Labour questions." It holds that if discussions are confined to "Labour questions" the main object of the Joint Industrial Councils will be sacrificed. We agree with the Council that there is still a great deal of work to be done in the education of the public as to the true needs of industry and the real functions of Industrial Councils.

The Council has arranged for a series of conferences and discussions to be held at 6 p.m. on alternate Tuesdays in September, October, November, and December, in the Hall of the Institute of Journalists, 2-4, Tudor Street, E.C., 4 :—

September 10th.—"Works Committees," Mr. Robert Wilson (Ministry of Labour).
September 24th.—"Trade Boards," Mr. J. J. Mallon.
October 8th.—"Interim Industrial Reconstruction Committees," Mr. W. Henderson Pringle (Ministry of Reconstruction).
October 22nd.—"The Place of Conciliation and Arbitration in the Whitley Scheme," Mr. E. H. C. Wethered.
November 5th.—"Women in Industry," Miss Lilian Dawson (Fabian Society, Women's Group).
November 19th.—"The Trade Union of the Future," Mr. George A. Isaacs (National Society Operative Printers and Assistants).
December 3rd.—"Functions of Industrial Councils," Mr. E. McGeggan (Ministry of Labour).
December 17th.—"Restriction of Output," Mr. Wilfrid Hill.

Sydney Electrical Trade Unionists and the Labour Union.—An Australian newspaper states that in June the Executive of the Electrical Trades Union recommended the withdrawal of that Union's affiliation from the Sydney Labour Council, as the latter was no longer a true reflex of the opinions of the Trade Union movement. The extreme elements which had obtained control were considered to be pursuing a policy inimical to the best interests of Labour. Certain delegates had adopted revolutionary policies which, if submitted to a referendum of their Unions, would not secure a 20 per cent. vote of the most militant bodies.

Fatalities.—At the resumed inquest in Dublin in regard to the death of Dennis White, an electrician, while working in a city munition factory, the jury found that death was caused by fracture of the skull resulting from an accidental fall, and expressed the opinion that there had been negligence on the part of the factory authorities.

Mr. M. H. Harris, permanent electrician, said instructions had been given that unauthorised persons were not to interfere with the switchboard, and temporary electricians (under which heading deceased came) were unauthorised persons. It was much safer, he added, to walk on the girders than to use a ladder. No instructions had been issued against entering the switchroom. Mr. W. Hesketh, engineer and manager of the factory, said there were plenty of facilities for erecting ladders, and he never encouraged men to walk along the girders. Mr. A. E. Porte, consulting electrical engineer, said that from his examination of the wire he was of opinion that had deceased taken the natural precaution of seeing that the main switch was open, the wiring on which he was working would have been dead and quite safe to handle. He admitted that the switches in the time office were on the wrong pole, and that Regulation 9 of the Home Office List was not complied with at the time of his visit. Under Regulation 28 a second person should be in attendance within reach.

Through touching an iron fence, on which was carried an electric cable which had become defective, Bombardier W. J. Ricketts, R.G.A., has been killed. At the inquest a verdict of "Accidental death" was returned. A doctor found only a small burn on Ricketts's hand.

An inquest was held, on Friday, on the body of Thomas Priest (36), fitter, Wednesbury, an employé of the South Staffordshire Tramways (Lessee) Co. A wire broke over the top of the live trolley; and as the company's regular wireman was on holiday, Priest, an experienced workman, was called out to attend to it. Priest mounted the covering of the top deck of the car, and endeavoured to cut the broken wire away; failing, he tried to snap it. The handle of the cutters apparently came in contact with the live wire, and Priest received a shock. Mr. G. A. Woolley, the company's resident engineer, stated that the tower wagon should be used for all repairs. Priest would have been quite safe had he gone to the nearest section box and cut off the current. A verdict of "Accidental death" was returned.

Foreign Trade.—The July Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	July, 1918.	*Inc. or dec.*	*7 months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	116,873	+ 16,905	— 177,337
Machinery	850,391	+195,449	+ 1,776,856
Exports.			
Electrical goods ...	161,003	— 85,929	— 658,349
Machinery	1,436,688	—476,398	— 2,437,424

Institution and Lecture Notes.—Electrical Power Engineers' Association.—On Thursday, the 15th inst., the London Western Section was inaugurated at Hammersmith. The chair was taken by Mr. G. C. Law, publicity secretary, and 19 undertakings were represented, the attendance including over 50 staff engineers. The chairman briefly outlined the history of the E.P.E.A., the advantages of its constitution, and the recognition by the Institution of Electrical Engineers and similar authorities of the E.P.E.A. as *the* protective Association for Staff Engineers of the electrical supply industry. The phenomenal growth of the E.P.E.A. had necessitated a measure of decentralisation, so as to secure the democratic control of the affairs of the Association. All non-members present agreed to become members of the Section. A strong Section Committee was elected, and meetings will be held on the first Thursday in each month. All staff engineers (lighting, power, and traction undertakings) engaged or residing in the area 5 miles west, north, and south, and 1 mile east of Hammersmith, who wish to become members should communicate with the Section Hon. Secretary, Mr. W. J. Wilcocks, 8, Willow Avenue, Barnes, S.W. 18.

Iron and Steel Institute.—The autumn meeting will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, September 12th and 13th, commencing at 10.30 a.m. on the 12th and at 10 a.m. on the 13th.

Amongst the papers to be read are the following:—

E. D. Campbell: "The Rate of Change at 100° C. and at Ordinary Temperatures in the Electrical Resistance of Hardened Steel."
D. Hanson and J. E. Hurst: "Case-Hardening Practice."
K. Honda: "On Magnetic Analysis as a Means of Studying the Structure of Iron Alloys."
Cosmo Johns: "Standardisation of Tests for Refractory Materials."
T. B. Mackenzie: "The Utilisation of Waste Heat from Open-Hearth Furnaces for the Generation of Steam."

A Limerick Wages Dispute.—In an award by Sir Plunket Barton, Dublin, in a wages dispute between Limerick coal merchants and dock labourers, the tonnage rate for the working of an electric crane at the docks was fixed at 1s. 3d. The demand was for 1s. 6d. and 9d. had been offered.

To Increase Coal Output.—We understand that the Government has decided on the immediate appointment of a practical coal expert, whose task it will be to devote all his energies to increasing the coal output of the country. This action is an indication of the gravity with which the Prime Minister regards the coal situation in relation to this country and its Allies. —*The Times.*

The A.S.E. and Working Hours.—The *Times* state that the A.S.E. has asked the Engineering Employers' Federation for a special conference to discuss the question of shorter working hours without a reduction of wages.

Electrical Engineer Fined.—At the Mansion House, Alderman Sir J. Knill imposed a fine of £100, with £21 costs, on each of three summonses against David Assersohn, electrical engineer, St. Bride Street, E.C., for having, between November 30th, 1917, and May 16th, 1918, committed certain acts in connection with a gravity petrol tank likely to render it ineffective, and calculated to deceive persons in the employ of the Ministry of Munitions as to its quality as war material.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 35, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Monday, August 26th, to Friday, August 30th.—Drills as usual.
Sunday, September 1st.—Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 9 Platform, for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Home Production of Fuel Oil.—The question of the production of fuel oil from home sources has been investigated by a Committee appointed by the Minister of Munitions. The report states that the best method is the carbonisation of cannel coal in existing vertical retorts at gas works, although no very largely increased quantity of oil can be obtained from this source during the war owing to difficulties of labour, coal transport, &c. Other sources of supply available in the future include boring for oil in Great Britain, the further development of the Scottish shale oil industry, and the increased carbonisation of raw coal. In the latter connection the report states that some 1¼ million tons of fuel oil might be obtained from every 20,000,000 tons of coal carbonised.—*The Times.*

Dublin Strike.—Over 10,000 artisans and labourers in the building trade struck work on Monday morning. They demand an increase of 3½d. per hour in wages, and reject the employers' offer of an increase of ½d. It is feared the trouble may spread, the Electrical Trades Union having decided to throw in its lot with other Trade Unions that may decide to take part in the strike.

Electric Lighting Sets on War-Service Motor-Cars.—In the early days of the war the specification of a W.D. motor-car included a dynamo lighting set, but, according to a letter from Major A. Warren-Lambert, A.S.C., in the *Light Car and Cycle-car*, it soon became apparent that these lighting systems, in the hands of the average driver, were not sufficiently reliable to meet the demands of the Services in France. The Major adds that, "in my capacity as officer-in-charge of a workshop at that time, I was continually having to withdraw from service for repair cars allotted to senior officers on the Army Staff solely on account of troubles with the lighting system, and eventually these became so serious that I removed the dynamo sets from the cars as they came in, substituting for them acetylene lamps and generators. The electric sets originally fitted included those made by practically every known concern, and, although the dynamos were fairly reliable, generally speaking, every other part of the equipment gave trouble. In fairness, it should be stated that the sets gave every satisfaction when fitted to cars which were not overtaxed, and were used on comparatively good roads at home; but they were not sufficiently reliable for cars used continuously, sometimes day and night, over exceedingly bad roads, such as are met with in the battle zone."

Electroculture.—According to the *P.M. Gazette*, crops of barley, oats, and potatoes have been treated with electricity in Glamorganshire with good results. Experiments are also in progress at Llantwit Fardre, under the direction of the South Wales E.P.D. Co.

Engineering Trade Unions and Amalgamation.—It is stated that on September 11th and 12th a conference of Trade Unions connected with the engineering industries is to take place, probably at York, to consider proposals for their amalgamation. The Electrical Trades Union and the Scientific Instrument Makers are included among the numerous bodies to take part in the proceedings.

Engineers and Whitley Committees.—The *Daily Chronicle* states that the A.S.E. London Committee has requested shop stewards and branches not to take part in forming Committees on the basis of the Whitley Report.

Production of Platinum in the United States in 1917.—The Geological Survey reports that, according to figures compiled by J. M. Hill, of the U.S. Geological Survey, only 605 oz. of crude platinum were sold by placer mines in 1917. This is less than the sales in 1916 by about 100 oz. The imports of crude platinum amounted to 31,921 oz., not counting the 21,000 oz. of Russian crude platinum which were received by the Government late in December. During 1917, refiners made about 33,000 oz. of platinum, 4,800 oz. of palladium, 633 oz. of osmiridium, and 210 oz. of iridium, which can be called "new metals." Of this amount about 7,400 oz. probably originated from domestic materials. The saving of scrap platinum of all classes resulted in much larger recoveries of secondary platinum metals than in previous years, a total of 72,000 oz. being recovered, as compared with 48,000 oz. in 1916.—*Bulletin* of the N.E.L.A.

Reactances at the G.E. Co., Buffalo.—The somewhat peculiar arrangement of the reactances and switchgear installed by this company is shown in the accompanying diagram (fig. 1). The

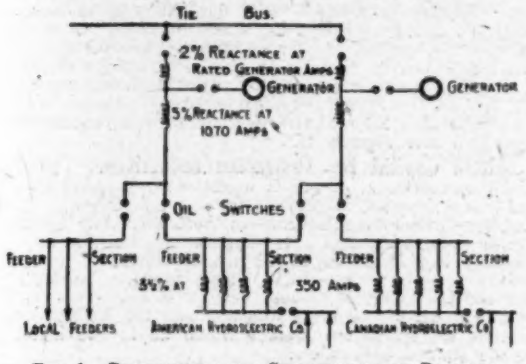


Fig. 1.—Reactances and Switchgear at Buffalo.

voltage generated at the company's station at Buffalo is 12,000 and the periodicity 25. A peculiarity of the system is that thousands of premises are supplied with alternating current for lighting purposes, which has a periodicity of 25. At the leading hotel in the city the rapid variation in the light of the incandescent lamps, due to this low periodicity, is quite apparent. The normal maximum daily load carried by the steam station is from 34,000 to 38,000 kw. About 38,000 kw. is drawn from one of the Niagara hydro-electric companies. The kw.-hours generated for the month of September last year were 11,487,000, and there were used on the works 281,000. The load factor for the month was 38·4 per cent.—*Commonwealth Engineer.*

Power Transmission in Scandinavia.—At a recent joint meeting of the Institutions of Electrical Engineers of Norway and Sweden, an instructive paper on "Inter-Scandinavian Power Transmission" was read by Major Hj. Johansen. The paper dealt with the progress that had been made in linking up the electric power stations in Norway and Sweden with Denmark; a summary of it, together with illustrations, appears in the Stockholm *Teknisk Tidskrift Veckoupplagen* for July 20th last (No. 64).

Educational.—Royal Technical College, Glasgow.—Particulars of the diploma and degree courses in Engineering, &c., for the new session (which begins on September 24th), arendvertised in this issue.

For Sale.—Buxton Corporation Electricity Department has for disposal a Belliss triple-compound engine, coupled to a Siemens dynamo, and two Laidlaw & Laidler dynamos, with spare armature; Salford B.C. Electricity Department invites offers for two 1,000-kw. Willans disk and drum type turbo-generator sets. For particulars see advertisement pages to-day.

Callender's Bowling Club Helps St. Dunstan's Hostel.—For the third year in succession the Bowling Club connected with Callender's Cable and Construction Co.'s "Anchor" Works, Leigh (Lancs.), have played a match with a selected teem representing the other bowling clubs in the Leigh district, the whole of the proceeds being remitted to St. Dunstan's Hostel for Blinded Soldiers and Sailors. This annual event took place on the "Anchor" Works Green last Saturday, and attracted a large number of visitors. Mr. J. Bowyer (manager of the Leigh Works), and Mr. T. D. Harrison (managing director, Messrs. Harrison McGregor, Leigh), led off for the respective sides, and the 30 games played were so keenly fought out, that the narrow margin of 12 points only decided the issue in favour of the "Anchor" team. Light refreshments were served in the canteen. The success of the event may be gauged by the fact that St. Dunstan's Hostel has benefited to the extent of over £60.

Chief Technical Assistants' Association.—At a special meeting of the above association held at Anderton's Hotel, Fleet Street, E.C., on Aug. 13th, the report of the delegates to the National Conference of the Electrical Power Engineers' Association, held at Manchester on July 27th, was considered, and it was decided unanimously to recommend all members of the C.T.A.A. to join the E.P.E.A. for protection purposes. The C.T.A.A., however, remains as a technical association, for the exchange of information among the senior men in electricity supply undertakings. Mr. W. E. Bradshaw, mains superintendent, Islington (Electricity Works, Eden Grove, N.) is acting as secretary to the Committee of Mains Engineers, which is investigating in detail the various methods of fault localisation in use, and particulars of the information and data required can be obtained from him. The Hon. Sec. (Electricity Works, Eden Grove, N.) is always pleased to put members who desire information on any special subject in touch with those members who can supply it, and where the subject is of sufficient general interest, the data will be collected and circulated amongst the members.

The American Turbine Industry.—According to the *Electrical Review* of New York, the turbine industry has been taken over by the Government as a necessary step in speeding up the production of prime movers for marine work; federal plants throughout the country, and necessary extensions to other needed plants. Taking over this industry probably means that the condenser industry will follow suit, part and parcel as it is of the turbine. Already the country has been sorely taxed in meeting the needs of marine work for surface condensers.

Electric Welding in Shipbuilding.—The General Committee of Lloyd's Register has confirmed recommendations of the Technical Committee with regard to the use of electric welding in shipbuilding. Elaborate experiments have been carried out, as the result of which a series of regulations has been compiled to control the use of the process.

An Electricity Works in the Roll of Honour.—*La Revue Générale de l'Electricité* states that the French Ministry of Munitions of War in an Order of the Day has commended to the notice of munition factories the fine conduct of the staff of the Compagnie d'Electricité d'Amiens. Under the energetic direction of M. Pasquier, the manager, and M. Husson, the engineer, the works with the greatest coolness, while exposed to a violent bombardment by shells and aerial bombs, continued to carry on the supply of electricity for the military, public, and private requirements in the neighbourhood of Amiens. One of the staff was killed and one wounded.

Aerial Cable Construction.—Mr. E. B. Meyer's paper read before the A.I.E.E. (*Proceedings*, Vol. XXXVII, No. 6) deals with the problem of supplying a high-tension electric service where conditions do not permit of the use of open wire or underground circuits. The methods of overcoming difficulties incidental to providing for high-tension service are discussed in detail, together with a description of the types of cable used and methods of installation.

One of the special methods adopted by the Public Service Electric Co., New Jersey, in meeting war-time demands, was that of furnishing the customer with primary service by the use of aerial cable run on poles and supported by messenger wire, a type of construction similar to that used in telephone work. This system was first used by the company about seven years ago, when it was found necessary to connect two large generating stations through tie feeders.

The matter of running overhead wire was considered, but found impracticable, because the line in several places would have to cross freight yards, trestles, and bridges, and the owners of these structures objected to open-wire high-tension lines. Most of the section

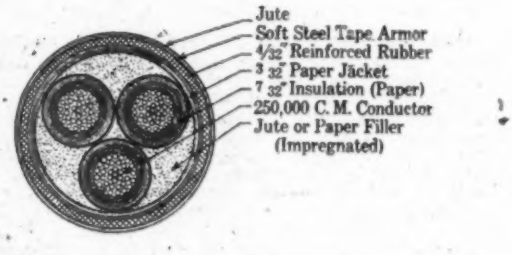


Fig. 2.—Reinforced Rubber-Covered Aerial Cable.

between these two stations was soil of a marshy character, through which it would have been impossible to run a duct line without the use of foundation piling.

It was, therefore, concluded that the use of aerial cable furnished the most satisfactory solution of the problem. In this installation ordinary lead-covered cable of the same type as that used for underground work was run on a pole line with 50-ft. pole spacing. To protect the sheath from mechanical injury there was applied a covering consisting of several layers of jute and marlin with an outer armour of soft steel tape. The use of lead-covered cable for aerial work was found undesirable, however, because of the excessive weight of the cable and the fact that it could not be installed on standard pole line construction, and a special form of 13,200-volt cable was developed to overcome these objections. This cable (fig. 2) is illustrated herewith.

Appointments Vacant.—Electrical engineer, for the Royal Victoria Infirmary, Newcastle-on-Tyne; teacher of electrical engineering for evening classes and teacher for instructing disabled soldiers in electrical wiring, for the Regent Street Polytechniq; shift engineer, £156 + 12½ per cent., for the Barnsley Corporation Electricity Department; two switchboard attendants, for the Northampton Corporation tramways; engineer-in-charge, £163, for the Tunbridge Wells Corporation Electricity Works; junior shift engineer, 55s., for the Heywood Corporation Electricity and Tramways Department; teacher of Engineering (£250 + £25 for evening work), for the Walthamstow Engineering and Trade School; shift engineer, for the Stretford U.D.C. electricity department; shift engineer (£208) and switchboard attendant (56s. 3d.), for the Birkenhead Corporation electricity department. See our advertisement pages to-day.

The Electrical Trades Union and the E.P.E.A.—We have received from Mr. W. J. Webb, the London District Secretary of the Electrical Trades Union, copies of correspondence which has passed between him and Mr. W. A. Jones, Hon. Sec. of the Electrical Power Engineers' Association. The latter forwarded to Mr. Webb a copy of a letter which his association had addressed to the Chief Industrial Commissioner, referring to the action taken by the Electrical Trades Union, in conjunction with other unions, in connection with the wages and conditions of employment of certain members of the technical staffs of electricity supply undertakings in the Metropolitan area, and reminding Sir George Askwith that on Oct. 20th, 1917, when this matter was previously before him, a memorial signed by the technical staffs of 34 power stations in the London area, protesting against the claims of the E.T.U. to act on their behalf, was sent to him by the association (then known as the A.E.S.E.). Mr. Jones stated that the authority of the E.P.E.A. to act on behalf of the engineers referred to was recognised by the I.E.E., the I.M.E.A., company chief engineers, and the Conference of Local Authorities on Wages, and the association was in negotiation with the Lancs. and Cheshire Chief Engineers' Association and the Conference of Local Authorities on Wages with reference to a schedule of salaries submitted by the association. He therefore requested that on any conference that might arise out of the demands that had been made, the association might be represented on behalf of the members of the technical staffs. Mr. Webb replied stating that the E.T.U. only dealt with *bona-fide* trade unions, and his committee would certainly object to the E.P.E.A. being represented at any hearing before Sir George Askwith or the Committee on Production referring to rates of wages and working conditions for all grades in electricity undertakings. He further said that members of the E.P.E.A. who considered it *infra dig.* to belong to the E.T.U. were not above receiving any awards that were got generally for the industry, through the agency of the E.T.U., and their interests would not suffer, but would be enhanced by the application made by the E.T.U. and other trade unions.

Other correspondence forwarded to us by Mr. Webb relates to the loan of a room at the Hammersmith Electricity Works to the E.P.E.A. by the Borough Council. He asked that the same privilege should be extended to the E.T.U. In reply, the Town Clerk stated that the use of the room by the Western Section of the E.P.E.A. had been discontinued, but he would bring the application of the E.T.U. before the appropriate committee of the Council. Mr. Webb then wrote expressing regret if his letter had been the cause of the discontinuance, but asking that the Council would allow the E.T.U. to use the room for the same length of time as it had been used by the E.P.E.A., on the ground that a large number of the members were ratepayers in the borough.

The Manufacture of Copper Wire in Australia.—According to the *Melbourne Age* for May 16th, which is just to hand, the announcement that the Victorian Government had decided to obtain supplies of copper wire for the railway department from America, at an increased cost of £7,000 over the British contractors' price, was received with great surprise in certain quarters, in view of the probabilities of the manufacture of copper wire being undertaken on a large scale in Australia in the near future. Commenting on the matter, the *Age* says: "The value of the contract to America is £31,000, and to retain that amount of money in Australia at the present time instead of sending it abroad is highly desirable, particularly as it would assist in the establishment of a new and important industry. When the British contractors announced that owing to the war they would not be able to execute the order placed by the Railway department for copper wire, officers of the department investigated the question, and decided that America was the best source of supply. Although, however, American firms can supply the article, the shipping difficulty has still to be overcome. When the wire will reach Australia, therefore, is problematical, and it is quite within the bounds of probability that Australian-made wire will be available before the American wire has been shipped. In any case, there has been so much delay already in connection with the electrification equipment that a little more in favour of one's own country would be readily excusable. At Port Kembla, N.S.W., over £100,000 has been spent in construction works by Metal Manufactures, Ltd., and for some time past everything has been ready for the installing of the machinery, the manufacture and dispatch of which from Great Britain has been delayed by the war. Some of the plant, however, has already arrived in Australia, while more is on its way, and unless further unforeseen delays occur it is expected that operations will be commenced in about a month. The manufacture of copper wire is only one of the many proposed activities of the firm, and in this connection it is stated that preparations are being made to supply the whole of the requirements of this country. At first, however, the output will be restricted to the capacity of the plant available, but it will be increased from time to time as quickly as the additional plant can be brought into use. In view of such facts as these, it is difficult to understand why the Railway department should find it necessary to spend an additional £7,000 to obtain copper wire from America. It is explained that the agreement of the Cabinet to an additional expenditure of £7,000 on electrification equipment in order to enable copper wire necessary to the present work of construction to be obtained from America, will enable half of the electrification scheme to be put into operation for certain as soon as it is constructed. The new arrangement will furnish sufficient overhead wire to enable the St. Kilda, Williamstown, and Port Melbourne lines to be completed, and they, in conjunction with the Sandringham-Essendon line, form about one-half of the suburban railways of Victoria. In speaking on the matter, Railway Commissioner E. B. Jones said that all these lines were now assured of coming into operation as soon as the work upon them was completed. The rest of the system he thought would probably have to wait until after the war, and with reasonable luck might be completed soon afterwards."

British Capital for Australian Industries.—The Victorian commissioner of public works recently stated that he knew of a number of projects for the establishment of industries—British manufactures—in Australia. The Commonwealth Government had sifted applications, but the Imperial Treasury had forbidden British manufacturers to remit the necessary capital to Australia. This attitude, if persisted in, said the commissioner, would have a serious effect on the Empire trade, for after the war was over the position would be that the Australian market would be in the hands of outside countries.—*Tenders.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Mr. B. Hall, of the Chatham & District Light Railways Co., having been appointed assistant engineer and manager of the Keighley Corporation Tramways, was presented with a case of instruments and a pipe, subscribed for by the company's staff and employés, Mr. Jensen, the general manager, making the presentation.

Mr. R. L. Acland, electrical engineer and tramway manager, Chesterfield, has been appointed by the Controller of Coal Mines to be the district engineer for the purpose of assisting in the Coal Economy Campaign.

Mr. J. A. Davison, mechanical engineer at Belfast electricity works, has resigned in consequence of a breakdown in health. The Electricity Committee is empowered to make a new appointment.

At Southport Town Council opposition was offered to the Tramway Committee's recommendation to increase the salary of Mr. T. J. Kendrew, the tramway manager, from £300 to £400 per year. Coun. Aveling said their tramways was regarded by the Government as non-essential—grade 3. They would have to reduce their mileage in the near future. Coun. Kennedy said Mr. Kendrew's salary in 1914 was £250, and in April of last year it was raised to £300. He had now the management of a much bigger undertaking than then, and no firm in the country would pay such a small salary. The proposal was taken back for further consideration.

The Ipswich Council has resolved to increase the salary of Mr. Ayton, the electrical engineer and manager, from £700, at which it has stood since March, 1913, to £850, as from March, 1918.

At a recent meeting of the Cape Town City Council a letter was received from Mr. W. F. Long withdrawing his offer to act as consulting engineer to the Council, and requesting a testimonial having regard to his services on behalf of the Council since 1902.

Mr. C. W. Gooden, of the Grays U.D.C. electricity works, has been appointed chief electrical assistant at the Horsham U.D.C. electricity works at £190 per annum. There were 31 applications.

On the occasion of his wedding, Mr. Arthur Wilkinson, of the Lytham and St. Annes Tramway Co., was presented with four silver pieces from different departments of the company.

General.—The staff of the electrical department of Messrs. Clayton & Shuttleworth, Ltd., of Lincoln, have presented a barometer and thermometer in oak case, and a butter dish to Mr. W. Watkinson on his marriage.

Owing to increased business of the East Anglian Engineering Co., Ltd., the "Bull" Motor Works, Stowmarket, have appointed Mr. H. C. Waters as chief draughtsman and electrical engineer. Mr. Waters served for a good many years on the motor draughting and design staff of Messrs. Crompton & Co., Ltd., of Chelmsford.

Roll of Honour.—Private J. A. Westley, Inniskilling Fusiliers, killed in action, aged 20 years, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private H. Saville, K.O.Y.L.I., who has been awarded the Military Medal, was on the staff of the Wakefield Corporation's Electricity Works.

Private F. Barnwell, Royal Marines, who enlisted from the works of Messrs. Willans & Robinson, Ltd., of Rugby, has died in hospital.

The Croix de Guerre has been awarded to Norman E. Gripper, Blackburn, who was killed in action in France in May last. He was on the staff of the Blackburn Corporation electricity works.

Private C. Owens, Royal Berkshire Regiment, who is a wounded prisoner of war in Germany, was at the depôt of the Bath Electric Tramways, Ltd.

Naval Electrical Artificer H. F. Rendall, who has been accidentally killed by an explosion, was an electrician with the English Sewing Cotton Co., of Belper.

Mr. H. S. Woodford, who was on the Rugby staff of the B.T.H. Co., Ltd., has been gazetted second-lieutenant in the Royal Engineers.

Private A. E. Harrison, Royal Sussex Regiment, killed, aged 19, was employed by Messrs. Greenwood & Batley, and previously at the Woolwich Borough Electricity Works.

Sapper A. Snow, who is a prisoner of war in hospital in Germany, was employed at Hanley Electricity Works.

Private F. W. Fletcher, who was formerly employed as a draughtsman by the Birmingham Electricity Committee, at Witton, is a prisoner of war.

The Military Cross has been conferred upon Lieutenant (Acting-Captain) C. Higgs, R.E., under the following circumstances:—When in command of the divisional signal company during heavy fighting and withdrawal lasting 10 days, his indefatigable energy, courage, and unfailing resourcefulness in maintaining communication largely contributed to a successful withdrawal and rearguard actions, in which the division took part. Throughout the period he worked with little rest, and set a magnificent example to all ranks. Captain Higgs is a partner in the firm of Higgs Bros., Summerhill Street, Birmingham. He was granted a commission in the R.E. about three years ago, and has been with the B.E.F. about 18 months.

Obituary.—Mr. J. M. Martin.—The death occurred last week, at Holmhill, Newmains, N.B., at the early age of 39 years, of Mr. J. M. Martin, general manager of the Chapel Coal Co., Ltd. The deceased was for some years on the staff of Messrs. Mavor & Coulson, electrical engineers, Glasgow, but succeeded his father in the position at the colliery about two years ago.

CITY NOTES.

Lisbon Electric Tramways, Ltd.

Net profit for 1917, £16,678, plus £9,224 brought forward; £10,000 has been put to depreciation reserve, leaving £15,902, out of which the preference dividend for the half-year ended June, 1917, amounting to £12,767, has been paid, leaving £3,135 to be carried forward. The passengers carried numbered 79,434,362, earning Es.2,754,964, as compared with 76,620,194, earning Es.2,324,655 in 1916, a considerable increase. Working expenses continued to increase, and were Es.568,381 higher than in the previous year owing to rises in price of coal and other supplies and in wages. The average of the rate of exchange fell during the year from 33.73d. to 30.656d., and is a further adverse feature. Owing to strikes and political disturbances, the system was closed down on several occasions, and the receipts for seven operating days were lost. The very serious reduction of profits prevented the payment of the preference dividend for the second six months of the year. A new Portuguese law prohibits any increase in price of season tickets for the duration of the war and six months after unless authorised by the Government, the General Council of the district, or by the municipality. This law is a direct violation of the terms of the company's concession. After the revolution in December a new Government came into power, and an agreement was arrived at with the Lisbon municipality under which the company was enabled to raise the rates of the season tickets by 40 per cent. as from January 1st last. The whole of the increase is required to meet the demands for higher wages. Certain further tariff increases have been made which will help to compensate for the ever-rising working expenditure.

French Supply Companies.

The Société Centrale pour l'Industrie Electrique, reporting on the year 1917, reviews at length the position of the various supply undertakings in which the company is interested. The directors state that as a general rule the supply industry presented the same characteristics as in preceding years. The receipts almost everywhere had progressed, and the hydro-electric works were in a prosperous condition. On the other hand, the companies using steam power found their situation becoming worse in consequence of the high prices and inferior quality of the coal. The company's net receipts from the investments amounted to £35,000, and after writing down furniture and installation the balance has been carried forward to the next account.

The directors of the *Société Lyonnaise des Forces Motrices du Rhone*, in presenting a balance-sheet for 1917 showing a great improvement over that for the preceding year, drew attention to the considerable increase in the working expenses owing to the general costliness, and the excessive wear and tear due to the necessity for meeting the growing demands for energy in connection with the national defence. As a consequence, the company had been compelled to consider the question of raising prices, and ministerial authority to do so was received last December. The number of customers at the end of 1917 was 39,130, and the horse power supplied was 40,692. The net profits are returned at £168,000, and the dividend on the ordinary capital of £1,200,000 is at the rate of £1 5s. 3d. per share, or 6.39 per cent.

The Société l'Ouest-Lumière reports that the results in 1917 were influenced unfavourably by the same causes as in the previous year, namely, the constant advance in the prices of raw materials, coal and wages, combined with the inferior quality of the coal and the abnormal wear and tear of the machinery and plant. Moreover, and notwithstanding the increases in the tariffs obtained from some private customers and various local authorities, the receipts were less than the working expenses, and the working closed with a deficit of £98,000, which, however, was reduced to £55,000 by the absorption of the balance from 1916. It was only possible to bring into operation at the end of the year the three boilers ordered in 1916, and therefore the improved conditions of working would first apply to the new financial year. The company had participated in the purchase of colliers with the object of overcoming the difficulty of freight, but owing to the delays in the delivery the year's working had benefitted only slightly from the expected economy from this source.

The report of the *Compagnie Générale de Distribution d'Energie Electrique*, whose principal scope is the supply in bulk of energy to traction and distribution companies, states that the gross receipts in 1917 amounted to £221,000, and the gross profits were £25,000, but special war charges converted the year's working into a loss of £27,000. It was possible to pay a dividend of 5 per cent. in 1915, but no distribution has taken place since that year. The directors remark that the war had entirely disturbed the industry. The working expenses, particularly owing to the rise in the cost of coal and labour and materials, were 45 per cent. higher than in 1913, represented in kilowatt-hours sold. On the other hand, the contracts running with customers were at very low rates and for a duration of several years, and the former refused to agree to any modification. In January, 1918, however, a law was enacted which permits of the adoption of procedure for securing a revision by mutual understanding or by having recourse to the courts, and negotiations were proceeding with some customers, whilst in other cases legal action was proposed to be taken. The new generating station which was begun before the war was now to be completed with the financial assistance of the State by means of two loans of £140,000, and new plant had been ordered for the existing station, so that the company would be prepared for the situation after the war.

The Société l'Energie Electrique du Littoral Méditerranéen, which, a few months ago, invited subscriptions in the English money market, report gross receipts of £543,000 in 1917, or £101,000 in excess of the preceding year. On the other hand, the working expenses largely increased, the final result being net profits of £135,000. This sum has permitted the declaration of a dividend of 6 per cent. on the ordinary share capital. The directors' report states that the production of the hydro-electric works made further progress during the year owing to the better utilisation of the power available and of the Largue works on the Durance, which was started in August, 1916. The number of lighting and power consumers experienced an augmentation, and the supply in bulk to other companies also increased. The contracts concluded with the administration of the national defence and the manufacturers working for this purpose had now reached the full yield, and it was only possible partly to satisfy the new applications received for supply. Dealing with the developments in hand the report states that it had been impossible to complete the extensions of the Ventaron and the Fontan works owing to the difficulties of transport, the recruiting of labour, and the supply of materials. It was, however, hoped to finish the former shortly, and the latter by the beginning of the winter.

The directors of the *Compagnie Parisienne de Distribution d'Electricité*, which is the amalgamated undertaking of the former supply companies or secteurs, state that the prolongation of the war renders the production and distribution of electricity more difficult and more costly in 1917 than in any one of the three preceding years. Notwithstanding the considerable reduction in the consumption for lighting, the great expansion in the use for motive power purposes compelled the company to work all the plant to the limit of its capacity. The production, which reached 176,912 kw.-hours in 1916, rose to 211,634,000 kw.-hours last year, the consumption by customers having been 128,263,000 kw.-hours, and 161,205,000 kw.-hours in the two years respectively. In 1913 the lighting service represented a consumption of 64,000,000 kw.-hours, and that of motive power only 23 millions, whereas the latter requirements in 1917 formed 125,786,000 kw.-hours out of the total consumption by customers. That part of the business which formerly was the accessory had now become the principal, and it had permitted war contractors to obtain cheaply energy which could only have otherwise been procured at a high price. The co-operation of the public authorities had assured the company of supplies of coal for the works, but despite the relief resulting from large deliveries of French coal the prices of all raw and other materials had risen enormously. As compared with pre-war quotations the company had to bear a surcharge in this respect of over £640,000, which had only been recouped in a very insufficient way by price increases agreed to by cu[s]

tomers. It had been necessary to make extensions of the generating works, sub-stations, mains, &c., in order to be able to supply new consumers. The convention with the City of Paris of 1907 laid upon the company the obligation to expend as from January 1st, 1914, a yearly average sum of £68,000 in extensions, but these had been carried out on such a scale as to exceed by £160,000 the actual amount to be defrayed by the company. This excess had to be borne by the City of Paris, and although a controversy remained open on the matter, provisional measures had been taken pending a solution. The gross receipts in 1917 amounted to £2,009,000, and after deducting working expenses, maintenance charges, taxes and general expenses, and the rental payable to the City of Paris on the gross receipts—£252,000, as against £170,000 in 1916—the balance remaining is £476,000. The interest charges on the debentures and the redemption account absorb £347,000, leaving net profits of £129,000, which with the balance brought forward makes a total of £227,000. The dividend is at the rate of 4 per cent. on the ordinary share capital of £4,000,000, the debentures still in circulation being for £3,635,000.

Brazilian Traction, Light & Power Co.—The revenue for the year to December 31st in Canadian currency was: Revenue from securities, $6,005,138; interest on advances to subsidiary companies, $198,560; general and legal expenses, &c., $937,180; net revenue, $5,266,518; transferred to general amortisation reserve, $250,000; dividends Nos. 16, 17, 18, and 19 at 1¼ per cent. each on preference shares, $600,000; dividend No. 18 at 1 per cent. on ordinary shares, $1,064,136; surplus carried forward, $3,352,382. The total gross earnings of the subsidiary companies in Brazil for the year were 92,200,309 milreis, being an increase, as compared with the previous year, of 7,258,077 milreis, or 8.54 per cent. The operating expense were 45,127,341 milreis, leaving the net earnings 47,072,968 milreis, an increase in net earnings of 546,772 milreis over those of the previous year.

Brisbane Tramways Co.—The "Times" is informed that the Brisbane Tramways Co. has received advice by cable to the effect that the two Tramways Bills which have been re-introduced by the Ryan Government have passed the Legislative Assembly, and have been read a first time in the Legislative Council with the single modification that the Purchase Bill has been amended so as to give the company the option of payment either in cash or debentures. It is an unfortunate omen that in the debate in the Lower House the Minister for Railways asserted that there was no contract between the company and the Government, and that, in any case, the present Parliament was not bound by the action of any previous Parliament.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Edison Swan Electric Co., Ltd.—100,000 first preference shares of £1 each, fully-paid, Nos. 1 to 100,000.

Madras Electric Supply Corporation, Ltd.—6,000 additional ordinary shares of £1 each, fully-paid, Nos. 180,001 to 186,000.

Adelaide Electric Supply Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less British tax, for the past half-year, on the 6 per cent. cumulative preference shares.

Melbourne Electric Supply Co., Ltd.—Dividend at the rate of 7 per cent. per annum, less British tax, for the past half-year, on the 7 per cent. first cumulative preference shares.

Para Electric Railways & Lighting Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

South American Light & Power Co., Ltd.—Dividend 5 per cent., less tax, for year.

STOCKS AND SHARES.

Tuesday Evening.

With the continuance of good news from the Western front, the Stock Exchange markets remain in good fettle. There is plenty of business amongst industrials. Rising prices are the order of the day in some of the electrical railway issues, in the Marconi group, and in various other directions. The gilt-edged markets are so firm that the 5 per cent. War Loan has risen to within all but a few shillings of its issue price of 95, so serving to maintain all investment stocks. Provincial Stock Exchanges are busy, too. One firm of brokers in a West of England town made £750 last week in brokerage alone, and the office staff consists of a lady and two lads.

Underground Electric Railways shares have been very active, the ten-pounders jumping to 3, while Bus "A" moved up to 8s. 3d. The strike made little difference to the market in Underground shares, and the Income Bonds kept fairly firm. In Districts and "Mets" business has been quiet, with prices good, though the market in steam stocks is somewhat patchy.

Electric lighting shares are practically unchanged. There is nothing to indicate the likelihood of any change in conditions at present, and proprietors are perforce obliged to follow the Asquithian rule of Wait and See. How the companies will be affected by the coal shortage promised us in the forthcoming winter, combined with the rationing order, is a matter that is more inviting to abstract speculation than to concrete investment.

The Brazilian Traction, Light & Power Co.'s report breathes chastened cheerfulness. The directors apparently intend to pay no more than 1 per cent. per annum on the common shares during the "continuance of the abnormal conditions produced by the war." The average rate of exchange is substantially better for the first half of 1918 than it was during the whole of 1917. Developments of Brazilian telephone undertakings have turned out satisfactorily. The shares appear to be worth holding.

Mexican affairs have taken one of their periodical turns for the better. The Mexican Government has modified, under protest, certain decrees that bore harshly on the oil industry, and this is taken as a hopeful sign for other commercial concerns in Mexico. Wherefore prices have taken a sharp upward turn, and look more healthy again. Anglo-Argentine Trams are also attracting a little favourable attention.

The Marconi market is very animated. American Marconis have taken the lead, and the price rose to 30s., while the parent shares are better at 4⅛ ex dividend. Marconi Marines strengthened to 3 bid, and Canadians are a little higher at 14s. 3d.

British Aluminium provided a pronounced feature of strength with a sudden rise to 40s. The British Platinium and Gold Corporation underwriters are said to have been left with about 85 per cent. of the issue on their hands. General Electrics are steady at 18⅞, while the preference remain about 10⅛. Callenders are better at 11½, ex the bonus. Babcock & Wilcox hover around 3⅞. Ediswan "A" shares are a good market at 48s. The armament group keeps hard, but rubber shares continue uncertain, with business slack in most sections.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 20. 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6¾xd	—	£7 17 0
Charing Cross Ordinary	5	4	3⅜	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11⅜	—	7 0 3
do. do. 6 per cent. Pref.	6	6	9¼	—	6 0 4
County of London	7	7	10⅜	—	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5¼xd	—	6 17 7
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3¼xd	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	7 1 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	5¾xd	—	7 19 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	+1½	£8 3 0
do. Def.	1½	1½	23⅜	+ ⅜	6 7 8
Chile Telephone	8	8	7½	+ ½	5 6 8
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	154	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10⅜	—	5 18 5
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	57½	—1	5 12 6
Marconi	15	20	4⅛xd	+ ⅛	4 17 1
Oriental Telephone Ord.	10	10	3⅛	+ ⅛	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	2	+ ⅛	*1 17 6
Western Telegraph	8	8	16⅛	—	*4 19 3
Home Rails.					
Central London Ord. Assented	4	4	63½	—	£6 6 0
Metropolitan	1	1	26½xd	+3	4 4 8
do. District	Nil	Nil	23	+1½	Nil
Underground Electric Ordinary	Nil	Nil	3	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/3	+1/9	Nil
do. do. Income	6	4	85½	+ ½	*4 13 7
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	£6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	8⅞	+ 1/6	—
do. do. 2nd Pref.	5½	—	2⅜	—	—
do. do. 5 Deb.	5	5	66	+ ½	£7 12 2
Brazil Tractions	—	—	45½	— 1	—
Bombay Electric Pref.	6	6	9½ xd	—	£6 9 9
British Columbia Elec. Rly. Pfce.	5	5	61⅛	—	£8 2 8
do. do. Preferred	Nil	Nil	45	—	Nil
do. do. Deferred	Nil	Nil	40⅜	—	Nil
do. do. Deb.	4⅜	4⅜	60½	—	£7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	51	+6½	Nil
do. 6 per cent. Bonds	Nil	Nil	42	+5½	Nil
Mexican Light Common	Nil	Nil	25	+4	Nil
do. Pref.	Nil	Nil	43½	+4½	Nil
do. 1st Bonds	Nil	Nil	56½	+7⅛	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅞	— ⅛	£3 17 2
British Aluminium Ord.	10	10	2	+ ⅛	£5 0 0
British Insulated Ord.	20	20	2	—	£5 0 0
British Westinghouse Pref.	7½	7½	2⅜	+ ⅛	£5 4 4
Callenders	20	25	11½	—	£6 4 6
do. 5 Pref.	5	5	4⅛	+ ⅛	£5 17 8
Castner-Kellner	22	20	3⅜	+ ⅛	£5 10 4
Edison-Swan, fully paid	—	—	3⅛	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	+1	£5 6 0
Electric Construction	7½	10	1⅛	—	£7 12 4
Gen. Elec. Pref.	6	6	10½	—	£6 5 4
do. Ord.	10	10	18⅜	+ ⅛	*£5 6 8
Henley	25	25	2⅛	+ ⅛	£5 16 0
do. 4½ Pref.	4½	4½	4	+ ⅛	£5 12 6
India-Rubber	10	10	16⅜	+ ⅛	*£6 0 4
Telegraph Con.	20	20	45	+ ⅛	*£5 7 8

*Dividends paid free of Income Tax.

WATER-POWER IN THE BRITISH EMPIRE.

(*Concluded from page* 152.)

At the present time the only parts of the Empire in which any systematic attempt has been made to collect and tabulate the necessary data are Canada and New Zealand, and to a smaller extent Tasmania, New South Wales, and South Africa.

It is a matter of urgent importance that the preparation of the necessary hydrographic and meterological data should be undertaken at the earliest possible date in the remaining Dominions and Dependencies of the Empire.

Great Britain and Ireland.—Much information relative to the water-powers of the British Isles is given in a paper* read before the Society of Arts in January, 1918, by Mr. Alexander Newlands, M.Inst.C.E., a member of the committee, who, assuming that 28 in. of the total rainfall in the Scottish Highlands is available for power, calculates that a total of some 235,000 continuous H.P. is available. Mr. W. Vaux Graham, M.Inst.C.E., has investigated 60 possible schemes in the Highlands, and arrives at the conclusion that an aggregate of upwards of 400,000 continuous H.P. is available, divided as follows: 10 above 10,000 H.P., 20 between 5,000 and 10,000 H.P., 20 between 2,000 and 5,000 H.P., and 10 below 2,000 H.P.

While the possible water-powers of the United Kingdom are comparatively small, yet, occurring as they do at no great distance from industrial regions, they are relatively valuable, and every effort should be made, by close investigation, to ascertain their commercial value at an early date.

India.—The power problem in India is in general complicated by the urgent necessity for conserving as much water as possible for irrigation purposes. Over the greater part of the country there are few perennial streams, and storage reservoirs for conserving the high rainfall of the monsoon season would be necessary. Many of the elevated valleys of the Ghats lend themselves to the construction of storage reservoirs, and a very large proportion (up to 90 per cent.) of the rainfall may be collected and stored. The Tata Hydro-Electric Undertaking receives its water supply from three such valleys. The total catchment area is only 22 square miles, but this is sufficient to give 100,000 E.H.P. for 3,600 hours per annum. Other projects of a similar type are under investigation in the Western Ghats. It is estimated that a continuous 300,000 E.H.P. may be obtained from the Koyna River alone; that 100,000 E.H.P. may be obtained from each of the rivers Vaiturna and Kali Nadi, and from the Andrha Valley; that a continuous 20,000 E.H.P. is available at Kali Nadi, Gersappa and Lushington Falls, and that, by a combined system of storage reservoirs, suitable also for irrigation purposes, a continuous 50,000 E.H.P. might be developed from this system.

The North-west corner of the United Provinces would also appear to be a promising locality for early development. At present the erection of a generating station on the Jumna is under consideration. From 40,000 to 50,000 H.P. can be easily and economically developed on the rivers Jumna and Tons, and as this region is thickly populated, there would be immediate markets for energy for the operation of cotton, rice, sugar, flour, oil, and saw-mills, and for other industrial undertakings.

There are also known to be many promising sites in the Central Provinces.

In Mysore the very successful Government undertaking on the Cauvery River has a capacity of over 22,000 N.H.P. The power is transmitted some 90 miles to the Kolar gold-fields and to Bangalore and Mysore, respectively 57 and 37 miles distant.

In the Native State of Kashmir an installation on the Jhelum river at Mohora is designed to develop 20,000 H.P., and transmits its power to Baramula and Srinagar.

In general the hydraulic possibilities of India appear to be very great. The country possesses in abundance the minerals necessary for metallurgical development, the climate and land for the cultivation of cotton, flax, jute, and many other commodities, and an enormous population which, if trained, would provide aoundant skilled labour. It is certain, too, that the demand for nitrogenous fertilisers will be enormous.

Ceylon.—Mr. H. T. S. Ward, M.Inst.C.E., estimates that at least 68,000 continuous H.P. is available even in the dry season at the falls of the Mahaweliganga and about one-half as much from the river Walawe Ganga. The water rights belong to the Ceylon Government.

Burmah.—The catchment area drained by the upper reaches of the rivers is about 80,000 sq. miles, and assuming it possible to utilise one-fifth of the discharge over a head of 500 ft., this would give a potential 7,000,000 H.P.

British Guiana.—While the water-power resources of this colony are comparatively large, no definite information is yet available. The falls of Kaieteur are said to form perhaps the finest untouched water-power in the Empire.

British Honduras.—Here also, while the water-power possibilities are known to be large, no definite information is available.

Canada.—During recent years, the Canadian Government, through the Dominion Water-Power Branch of the Department of the Interior, has devoted much attention to the systematic examination and development of the hydraulic resources of the Dominion, and the data, as regards the largest, most readily available, and most promising water-powers are sufficiently complete to permit a reasonably close idea of their possibilities to be obtained.

The Canadian Conservation Committee estimates that of the 3,730,000 square miles of the Dominion, 2,000,000 miles may be expected to be fairly thickly settled within the next few decades. The remaining area is known to have thousands of water-powers, but the capacities of these are imperfectly known, and they are remote from any present market. Excluding these districts, it is estimated that 18,800,000 H.P. is available. This amount does not take into account the possibilities of storage for the improvement of present capacities. The power actually developed up to 1918 amounted to approximately 1,736,000 H.P. About 78 per cent. of this is used for electric light and electric railway and motive-power work, but some 250,000 H.P. is utilised in the manufacture of paper from wood pulp, and about 150,000 H.P. in electrochemical and similar processes.

Powers as yet undeveloped, but which are capable of rapid and easy development, aggregate 5,400,000 H.P. In addition to these existing plants could be extended so as to develop an additional 280,000 H.P. so that an aggregate of 7,500,000 H.P. is readily available within range of present markets. At the present accelerated rate of development it appears more than probable that the whole of this energy will be utilised within the next 20 years or so.*

To its wealth of water-power, the Dominion adds the advantage of a great share in the world's forest and mineral resources. Coal, iron, copper, nickel, gold, silver, cobalt, lead, asbestos, and mica are widely distributed, and the proximity of large hydraulic powers to the mineral deposits will prove a great stimulus to the development of both.

The policy of the Government in respect to the control and administration of water-powers is that the title should be retained by the Crown, that the public should be protected by securing the maximum possible advantageous development of each river, by control of the rates, by reasonable rentals, &c., and that at the same time the inducements should be such as to encourage legitimate enterprise for the development of power resources.

Newfoundland.—The water-powers of Newfoundland are known to be of considerable importance. So far about 6,000 H.P. has been developed for general industrial purposes and lighting. About 54,000 H.P. has been developed for use in the pulp and paper mills.

Australasia.—With the exception of New Zealand, the water-power resources of Australasia have never been systematically surveyed.

Estimates have been made of a few of the more promising hydraulic powers of Tasminia. The Agent-General (Sir John McCall) estimates the possibilities at about 400,000 H.P. The State Government proposes to utilise the water of the King River in the near future to supply some 40,000 H.P. to the mining districts in the West. So far only three hydraulic installations have been developed. These are the Great Lake scheme, at present developing over 12,000 H.P.; the South Esk scheme, developing 1,350 H.P.; and the Lake Margaret scheme of the Mt. Lyell Mining Co., developing 4,000 H.P. The Great Lake, with a head of 1,120 ft., is capable of developing 70,000 H.P. The plant is now being enlarged. Part of the power is to be used for zinc reduction and calcium carbide production.

In view of the shortage of water-powers in Australia, and of the future demand of the Commonwealth for nitrogen products, &c., there should be no difficulty in finding a market for the output of all the energy which can be developed in Tasmania. Though comparable in area with the United States, there has yet been no notable hydro-electric development in Australia. The only possibilities of considerable powers are to be found in the rivers draining the Great Dividing Chain of the East Coast. Probably the possibilities of the Australian Alps lie between 300,000 and 500,000 H.P.

The *Blue Mountains*, to the West of Sydney, form an important high-level catchment; the available power is likely to be between 25,000 and 50,000 H.P.

The *New England Range* in New South Wales and Queensland has available power probably between 200,000 and 500,000 H.P. The State Government has outlined a power scheme for the river Clarence capable of producing 150,000 H.P.

In Queensland, *Cairns District*, the available horse-power probably lies between 150,000 and 400,000 H.P. The Barron River Falls would yield at least 10,000 H.P. This district is favoured in respect of shipping facilities and is rich in copper, tin, and other minerals.

The aggregate power suggested as being capable of economic development in the Great Dividing Chain is from 625,000 to 1,300,000 H.P. In all cases the scheme would be somewhat expensive to develop, but in view of the general high cost of power in Australia, it would probably not be prohibitive.

New Guinea.—The physical characteristics of New Guinea offer exceptional facilities for developing water-power. There are numerous rivers of large volume and steep gradient, and there is evidence that in the aggregate, the available power

* Abstracted in the ELECTRICAL REVIEW, February 8th, 1918.

* An account of the Canadian water-powers was given in the ELECTRICAL REVIEW of February 23rd, 1917. See also ELECTRICAL REVIEW, May 18th, 1917.

is enormous. German New Guinea, the territory occupied by the Australian forces during the present war, has also great prospects. Altogether the potential water-power in the section of the island now under the British flag may amount to as much as 15,000,000 H.P.

Some few of the islands of the South Pacific Ocean offer possibilities of hydraulic power on a fairly large scale in spite of their comparatively small size.

The physical characteristics of New Zealand render the country particularly well adapted for providing large stores of water power, and for facilitating their development. The backbone of high mountains leads to heavy precipitation from the moist westerly winds, and the mountain ranges are studded with extensive lakes, situated above a deeply indented coast line, and support many glaciers of large size which act beneficially in equalising the run-off throughout the year. A list of 72 important and promising schemes places the economically workable water-powers of the Dominion at 3,700,000 B.H.P. on the turbine shafts. Of this, 500,000 H.P. is found in North Island and 3,200,000 in South Island. The power actually developed and in use in 1916 is given in the Government returns as 42,600 B.H.P. Many other projects are, however, in course of construction or under consideration.

The Public Works Act of 1908 vests the sole right to use water-power in His Majesty, subject to any existing rights, and gives the Government the right to develop, or to delegate such power to any local authority, or, outside a mining district, to any person or company, subject to conditions. Advantage has been taken of this in several cases, the right in the case of local authorities being issued free of royalty, and in the case of private individuals developing water-power for electrical distribution, subject to a royalty of 0.05d. per unit generated.

The outlook for New Zealand, at the dawn of what promises to be an era of unexpectedly great electrochemical, and electrometallurgical activity, is most promising. As a centre for the manufacture of nitrogen products, aluminium, calcium carbide and the like, its situation is ideal. The fundamental requirement, a great excess of energy over the power needs of the country, is provided. Further, that power is convenient to the coast; in some of the largest schemes the generating plant will be actually on deep-water harbours.

South Africa.—Owing to the seasonal character of the rainfall throughout South Africa, the flow of the rivers either is greatly diminished, or entirely ceases, during a considerable period of each year, and their value as sources of power is correspondingly diminished. It is, however, known that a number of important falls occur, particularly on the eastern slopes of the Drakensberg Range, some of which are perennial and capable of development.

In Rhodesia the rivers capable of developing large powers are in general very remote from present centres of industry, and few powers have as yet been developed.

Assuming that 10 per cent. of the total power of the Victoria Falls can be usefully developed, the resources of Southern Rhodesia total about 220,000 E.H.P.

East Africa, West Africa, Egypt.—In East Africa many promising waterfalls occur in the vicinity of Nairobi and elsewhere. On the Gold Coast some 250,000 H.P. is available, and in Nigeria between 60,000 and 70,000 H.P. Some considerable amount of power might be developed from the regulated flow of the Nile, and it is hoped to obtain information regarding Egypt in the future.

MINING ELECTRICAL ENGINEERING.*

By CHRIS. JONES, M.I.E.E.

(*Concluded from page* 151.)

The question of applying the proper type of motor for various specific duties is of the greatest importance to all concerned. The two chief kinds adopted in the past were the squirrel-cage and slip-ring induction motors; the former in view of high efficiency, simplicity, mechanical strength, and absence of sparking (the three first items keep the maintenance costs down), and the latter makes it particularly suitable for installation in coal mines and other dangerous places. It has the disadvantage of having a low starting torque, and will not start against heavy loads, and causes disturbances in the lines when started up, but the latter is not serious. The writer has a large number of coal-cutters fitted with this class of motor, and can thoroughly recommend it for such purposes, all bearings being of ball and roller type. There are a great many other drives in colliery work where it can be used with advantage. The slip-ring type of motor is chiefly used for starting up against heavy loads and where speed variation is required, such as for main and tail haulages. The writer has a large number of these doing excellent work, the chief cause of the few troubles having been due to defective and weak bolting down girders and cast wheels on haulage gears causing excessive vibration. With substantial foundations and machine-cut wheels such troubles are greatly minimised. It is good practice to specify for the phase connections to be brought out to a terminal box, as this greatly assists fault-finding. The proper rating of motors is a question that is well worth ventilating.

In connection with A.C. motors and turbine pumps it is necessary to specify that the pump shall do its full load duty at a reduced frequency, for the duty of the pump is dependent upon speed, which, in turn, is dependent upon the frequency. Manufacturers would greatly assist users by standardising cable trifurcating boxes for stator connections. These are required to be easy of detachment, so that the cables and motor windings may be tested independently. In some designs this is not possible, and is the cause of great delays. Motors are supplied to collieries at the present time with plain terminal boxes suitable for rubber tails. Some makers have gone so far as to make them so large that a diagram of connections is cast on the front cover, and they are to be recommended. In one case recently inspected the bare terminal was such that it could be easily touched by the attendant. Users are often told that breakdowns of motors are due to dirt or inefficient protection, and breakdowns do occur owing to such neglect.

It is essential to specify that all windings should be impregnated with damp-proof varnish where in exposed position; it is well worth the extra cost. The question of the type of windings must also be given the best consideration when considering competition offers. A case in point is where three coils in a hand-wound motor were repaired, the cost being £24, whereas a former wound coil could be stripped and rewound for £4.

The author has experienced overheated motors on account of unstable conditions of transformers which had the primary and secondary γ connected. The question of the construction of motor houses, and transforming sub-stations underground, is worthy of special consideration as the designs, &c., have a great effect on the successful operation of such apparatus, which is frequently overlooked.

The tendency to-day is to install totally enclosed iron, or steel clad, oil immersed circuit-breakers for high and low tension, even for power house and surface, and underground sub-stations, &c. This is to be highly recommended in view of eliminating the possibility of contact with live conductors, the whole being surrounded by efficiently earthed metal cases. Oil switches should be large enough to open the circuit in safety under the worst conditions, which will probably be a short-circuit on the cables just beyond the switch. It is good practice to standardise oil switches for certain ampere and volt capacities, the rates being the same for 600 and 3,000 volts. Of course, the current transformers, trip coils, and meters are made to suit each individual feeder. For safety, the ideal gear is a draw-out panel, as this is specially recommended as affording the maximum protection to life. A clear understanding of the apparatus by those who are permitted to operate the gear is necessary. All electrical apparatus should be treated as if it were alive until positive proof is obtained that it is all dead. The writer has known cases of one-phase contact of an oil switch remaining in contact after the switch has operated. It is, therefore, best to install isolating links between line switches and apparatus in order to ensure maximum safety. There is room for improvement still in some designs. Some makers adopted alternative methods for cable leading in and out. Fig. 7 (p. 150) shows a good design which can be adapted to suit different conditions. In some makes it is only possible to lead in at the top, in which case a large bend in the cable has to be provided, which necessitates a great height of switch house, and which is impossible in some underground positions. Fig. 8 shows cable boxes standardised by the author in connection with switchgear, these being for types as shown.

The subject of standardisation of switchgear for mining work is one that deserves special mention. The writer suggests that this institution should endeavour to bring about standardisation of trailing cable plugs and sockets for portable machines and gate-end switches, &c. The author, when inquiring for switchgear, has often been informed that his requirements did not meet with the maker's standard design, with the result that gear has had to be purchased and altered on site. The use of discriminating leakage protective gear is to be highly recommended for mining purposes. The author has dealt fully with this subject in a paper read before the A.M.E.E. (see Vol. 4). There is a feeling that these are complicated devices, but this is not the case; current transformers and trip coils of the standard gear can be used, the only additional device being the relay, which is a very reliable piece of apparatus. The author favours the auxiliary source of supply for tripping purposes.

In connection with leakage trip gear, it is the writer's practice to install neutral point switches in conjunction with leakage indicators, so arranged that the leakage indicator is inoperative when the neutral switch is closed.

The use of liquid controllers has become greater of late, while they have, no doubt, their advantages as regards flexibility of control, they have their disadvantages for use while on auxiliary haulages in-bye in mines, owing to the amount of water required. In some cases they have been introduced in order to reduce the number of cable leads that require to be mechanically protected, but the writer's practice is to install metallic resistances, oil and air cooled with oil-immersed controllers of type as per fig. 8. Instances may

* *Proceedings*, South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

be given of fairly large sizes where the cost of renewals has been practically nil for two years. With such types care has been taken to have contacts of liberal capacities, and care should also be taken that all such are in alignment, which is very important for the efficient working of such controllers. Interlocked type of control gear is highly recommended for all works and colliery practice.

It is necessary to rigidly define the requirements and conditions under which such apparatus has to work, otherwise short-time ratings are offered, which are cheap to buy, but most expensive to maintain. The contactor system of control is worthy of serious consideration for the control of large A.C. motors. It has numerous advantages over liquid starters when full speed of the motor is obtained. For instance, when the last rotor switch closes the motor is mechanically short circuited. This is a great advantage, because it

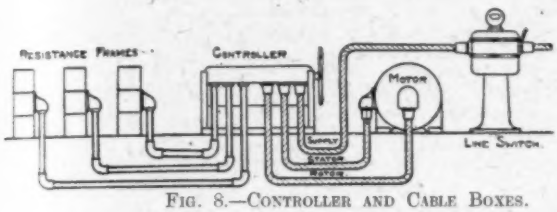


Fig. 8.—Controller and Cable Boxes.

is impossible to work with a less slip with liquid resistance than about 10 per cent. Contactors are very reliable and handy apparatus.

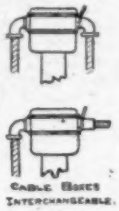
It has occurred to the writer that standard connecting socket plugs suitable for making quick connections for use with watt meters, power factor meters, &c., on motor line panels would be of great service in order that such measurements may be taken by a person on his routine periodical examination of electrical installation without having to make temporary connections, which is most difficult with fool-proof gear. It is also essential to give greater attention to the electrical conductance of metal parts and cases of instruments. It is quite common to find heavy current motors, line panels, controllers, &c., delivered with very small earthing lugs, and 3/16-in. and ¼-in. set pins supplied to secure them to the frames.

Earthing is now recognised as a necessary and important factor in connection with colliery electrical installations. A good method of earthing is to use three plates connected together to a common bus-bar to many circuits; by disconnecting from the bus-bar it is easy to make tests. The wires and connections to the earth plates should be insulated to obviate corrosion and to have an ammeter and voltmeter with multiple-way switch, and so arranged that tests between plates may be easily effected. A good motto is to consider a broken earth wire as serious as a bare conductor.

It is very necessary that all persons in charge of electrical apparatus should be trained, and all men operating switchgear and other electrical apparatus should be properly instructed by an electrician as to the proper handling of same.

In order to obtain the maximum of safety, reliability, and economy in the installation and maintenance of mining electrical plant, colliery owners may well be advised to obtain practical and technical men, with good organising abilities, to advise them concerning their requirements, as by defining the requirements rigidly, quotations can be properly compared. One of the ways of gaining knowledge is to share with others what knowledge we possess. We cannot live to ourselves. If progress is to be made in any sphere of life, it must be by combined effort, and this is now being recognised in every direction. The writer will conclude by expressing his very best thanks to the management of the Cannock Chase Colliery for permission to put forward photographs, &c., and to others for assistance in connection with the paper.

Discussion.—In the course of his reply to part of the comments upon his paper, the author said that, with reference to the requests of Mr. Watkins and Mr. Forrest for more information in regard to the static condensers, he had not had the slightest trouble with any of the sets since their installation. The switch controlling the condensers from the bus bars was of the oil-immersed type, fitted with charging resistances on the contact finger. The efficiency of the condenser at ordinary frequencies and temperature could be safely accepted as 99.5 per cent. The condensers were made up of a specially selected tinfoil applied to a very thin tissue paper. The dielectric consisted of several layers of special interleaved tissue paper, and the whole was immersed in best quality oil. They were built in units of about one microfarad—the units being assembled in a strong, sealed metal case in such number as were required to make up the total microfarad capacity. The temperature rise did not exceed 20 deg. Fahr. He (Mr. Jones) was glad to inform the members that these condensers were now in satisfactory use on 3,000-volt circuits—a fact which should greatly assist engineers in improving the power factor of their systems. It would be noticed that lamps were used on the sets shown in the paper, in order to dissipate the charge which might be left in the condenser on switching off. The makers had now designed a special oil switch, by which the condenser was switched on or off through these resistances. As to the question of costs, the following might be of use: To improve the power factor of a 500-kw. load (working at 3,000 volts, 50 periods) from 0.6 to 0.9 a capacity of 1,500 microfarads would be required, having an output of 424 k.v.a. The cost would be £1,350, complete with switchgear. If the condenser was required to deal with a similar load, but 25-period instead of 50-period, its cost would be approximately double, as the amount of capacity required was inversely proportional to the frequency. For a 600-volt circuit the cost was approximately the same as for a 3,000-volt circuit. In the case of the power factor of a 40-h.p. motor working at a load of, say, 33 kw. and a power factor of 0.5 to be improved to 0.95, the capacity required would be 400 microfarads and the cost would be £50. If the motor was working at a power factor of 0.65, a capacity of 240 microfarads would be required—price, £48. As a power factor of 0.95 was higher than the usual specification, the following might be of interest: To improve the power factor of the load referred to from 0.5 to 0.9, the capacity required would be 270 microfarads, and the cost £54; or to improve from 0.65 to 0.9, 190 microfarads, at a cost of £38. It must therefore be seen that the difference in capacity to improve from 0.9 to 0.95 was very considerable, and the advantages gained might, in most cases, not be worth the increased expense. Replying to Mr. Watkins, who agreed with earthing the neutral thoroughly, but suggested that the main plant should work insulated, Mr. Jones thought this was not to be recommended in view of the fact that all faulty circuits should be automatically made dead, which was provided for with earthed neutral systems and leakage-protective gear.



Mr. Jones was pleased to hear that Mr. Forrest agreed with reference to earthing the neutral; his own practice was to put artificial faults on periodically, in order to test the system under working conditions as near as possible. It was erroneous to think that, once automatic protective gear was installed, less supervision was required.

REVIEWS.

Essentials of Electrical Engineering. By J. F. Wilson, B.S., E.E. London: Constable & Co., Ltd. Pp. 345+viii; 282 figures. Price 10s. 6d. net.

The greater part of this work is devoted to the study of direct and alternating current dynamos and motors; lamps, accumulators, meters, and switchgear are also investigated, though in a less complete manner. In the preface and throughout the book the author lays stress on the fact that direct and alternating current circuits are governed by precisely the same laws, thus in chapter 1, which deals with the laws concerning the flow of current in simple circuits, we find from the first that stress is laid not only on the effect of resistance, but also on the effects of inductance and capacity. We notice here, by the way, that one definition given of the power factor of a circuit is that it is equal to $\cos \phi$; it is desirable to point out the limitation of this statement even at this early stage.

The next chapter deals with electro-magnetism and its allied subjects, and would be more valuable if additional matter had been included dealing more directly with calculations concerning commercial types of field magnets. Chapter III is devoted to the constructional details of direct and alternating current machines, the treatment being quite brief.

The operation of direct current machines is considered in a much more comprehensive manner, and forms a valuable section of the book. The Tirrill automatic regulator seems to be almost invariably introduced in books of American origin, and it is remarkable how frequently the treatment is unsatisfactory. Thus, in the present work, an application of the regulator to a direct-current machine is given on page 72, and the descriptive matter does not agree with the diagram. In the former the relay is described as being differentially wound, but on referring to the diagram a single winding only is shown. Later in the book another diagram is given, the relay this time being shown with a differential winding.

In the chapter on current rectifying apparatus particular attention is paid to the rotary converter, and an interesting account of the mercury arc rectifier is included; no special mention is made of the motor converter, a type of machine which has many advocates in this country.

Synchronous and induction motors are dealt with at length, and a brief chapter is devoted to single-phase commutator motors. Transformers are dealt with in an adequate manner, special attention being paid to the interconnection of multi-phase transformers for converter working.

In regard to work not directly connected with machines, chapters are included dealing with lamps, switchgear, instruments, transmission circuits, and accumulators. Of these,

the chapters on instruments and transmission circuits are by far the best, the former giving an account of all the types of instruments likely to be met with and the latter including some valuable formulæ and tables. The chapter on lamps is probably the least satisfactory, the proportion of the matter dealing with types which are little used or are tending to disappear being far too large and tending to exclude work dealing with modern filament lamps.

There are four appendices dealing with harmonic quantities, inductance, capacitance, and complex quantities respectively, and these form one of the most valuable portions of the book, since much useful mathematical work is included which is rarely met with in ordinary text books.

The examples with which most of the chapters are furnished may be commended as being of a most useful and practical kind.

In one or two sections (notably in machine-starting gear and lamps) there is a certain lack of information in regard to the most recent work and methods, this perhaps being accounted for by the fact that the preface date is now nearly three years old.

The figures are well reproduced, though in some cases they are on rather too small a scale, and the book is well printed on excellent paper.

The work may be well recommended to day and evening students who have a reasonable mathematical knowledge, and also to men engaged in power station and transmission work who desire to improve their acquaintance with the mathematical side of the subject.

Mathematics for Engineers. Part I. By W. N. Rose, B.Sc. (The Directly-useful Technical Series.) London: Chapman & Hall. Pp. 510; figs. 257. Price 8s. 6d. net.

This book forms volume I of an ambitious treatise in which the author intends to cover all the mathematical work needed by engineers in their practice, and by students in all branches of engineering science. The volume under review includes elementary and higher algebra, mensuration, graphs and plane trigonometry; it is intended that Volume II shall complete the work and include the calculus and its practical applications, differential equations, harmonic analysis, spherical trigonometry and vector analysis.

It may be said at once that Mr. Rose's book will stand comparison with the many excellent text books of practical mathematics which are already in use, and the impression obtained on a first perusal is entirely a favourable one.

The first chapters deal with indices, logarithms and equations with considerable thoroughness. A great number of examples are given, the majority of which, both worked and set, have a direct bearing on engineering practice. Mensuration is treated very comprehensively in a chapter of about 70 pages, and here again excellent series of set and worked examples occur. The subject is taken as far as the rules of Guldinus, and also includes a brief treatment of elliptical and parabolic figures. Chapters 4, 9 and 10 deal exhaustively with graphical processes including the plotting of functions and statistics, the determination of laws and the solution of equations. The work on the construction and use of various diagrams used in the study of heat engines, notably the P V and Tϕ diagrams, should prove useful to students of thermodynamics. Graphical methods as applied to the construction of practical charts, and particularly alinement charts, are given special attention in a separate chapter.

In chapter 5 algebra is taken as far as the progressions, and more difficult equations involving logarithmic computation are dealt with. The seventy excellent examples which close this chapter may be regarded as ideal practice for the engineering student who lacks facility in the use of logarithms.

The section devoted to trigonometry follows more original lines than the rest of the book. Much of it is beyond criticism, and there are many useful examples, but the author diverges seriously from common practice when he uses the north and south line as the standard line of reference and the clockwise rotation as positive. Were it only trigonometry that would be affected we could see little harm and some advantage in the change; but so long established a usage has naturally taken its place in other branches of mathematics, and we shall await with interest the author's treatment of polar co-ordinates to which the same conventions apply. We are of the opinion that the inevitable confusion that would result is far too high a price to pay for so little advantage. The sections and examples on complex quantities and vector multiplication should prove of value to electrical students.

The various methods of finding irregular areas are treated fully in Chapter 7, the theory of the planimeter being left for treatment in the second volume. A unique chapter on the calculation of earthwork volumes serves to provide examples in the mensuration of both regular and irregular figures, and incidentally to give much information of a practical kind to the engineer who may be called upon to tackle surveying and levelling problems.

A final chapter extends the algebra to partial fractions, limits, permutations and combinations, the binomial theorem and the exponential and logarithmic series. The mathematical tables at the end of the book include four-figure logarithms, Napierian logarithms, natural and logarithmic trigonometrical ratios, and exponential functions. There are also answers to all the numerical examples and an index.

There is very definite evidence throughout this book that it is the work of an actual teacher who knows exactly where difficulties are likely to arise and how to elucidate them. The practical nature of the examples is also a recommendation, and altogether we are inclined to regard Mr. Rose's attempt to write a really practical book on sound theoretical lines as a distinct success. It is certainly worthy of careful perusal by teachers of practical mathematics.—P.H.S.K.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,725. "Electric cable conduits and their fittings." W. H. Bereesford and J. McDougall. August 6th.

12,749. "Accumulators, storage batteries, &c." J. F. Hutchison. August 6th.

12,750. "Sparking plugs, &c., for internal-combustion engines." H. V. J. Jouffret. August 6th. (France, April 25th.)

12,765. "Dynamos for production of uniform continuous current." Eversheb & Vignoles. August 6th.

12,828. "Recording apparatus for electric current impulses." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 7th.

12,839. "Magnetos for internal-combustion engines." A. Anzani. August 7th. (France, August 7th, 1917.)

12,869. "Automatic telephone systems." Automatic Telephone Manufacturing Co. August 8th. (U.S.A., October 13th, 1917.)

12,877. "Electric power systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 8th.

12,932. "Electric incandescent lamp fittings." J. T. Jackson. August 9th.

12,949. "Automatic telephone systems." Automatic Telephone Manufacturing Co. August 9th. (U.S.A., September 19th, 1917.)

12,959. "Dynamo-electric machinery." J. H. St. H. Mawdsley. August 9th.

12,960. "Electrolytic method of cleaning iron or steel." Q. Marino. August 9th.

12,963. "Automatic regulators for dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 9th.

12,968. "Magneto-electric machines." B. Wolkoff & W. Wolkoff. August 9th. (France, August 9th, 1917.)

13,024. "Electric furnaces." T. Rondelli. August 10th.

13,025. "Holding electrodes in soldering and depositing metals by electric arc." E. H. Jones & Alloy Welding Processes, Ltd. August 10th.

13,026. "Manufacture of electrodes for soldering and depositing metals by electric arc." E. H. Jones & Alloy Welding Processes, Ltd. August 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

9,339 Terminal-box electrical cable or conductor insulators. British Insulated & Helsby Cables, Ltd., and R. W. Bladen. June 29th, 1917. (117,478.)

10,119. Means for the production of high-voltage discharges. N. F. S. Hecht and Creed & Co. July 12th, 1917. (117,480.)

10,317. Illuminating devices containing electric incandescent lamps. British Thomson-Houston Co. (General Electric Co., U.S.A.) July 17th, 1917. (117,490.)

10,443. Device for guiding the trolley pulley of an electric car into contact with its overhead wire. E. B. Moyse. July 20th, 1917. (117,498.)

10,448. Electric radiators. Simplex Conduits, Ltd., & L. M. Waterhouse. July 20th, 1917. (117,499.)

10,694. Electric drilling apparatus. H. Scholey & F. K. Woodrofe. July 25th, 1917. (117,505.)

10,843. Electric batteries. Syndicate Graaman's Patent. July 29th, 1916. (108,482.)

13,407. Liquid rheostats. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) September 18th, 1917. (117,532.)

13,441. Apparatus for the electrolysis of water. K. Kimura. September 20th, 1917. (117,533.)

13,788. Sparking plug for internal-combustion engines. M. Ferraris. September 25th, 1917. (117,537.)

13,990. Lanterns for incandescent electric lamps. H. T. Wilkinson and Wardle Engineering Co. September 28th, 1917. (117,538.)

14,025. Telephone exchange systems. Western Electric Co. October 11th, 1916. (110,354.)

15,228. Electric time relays. A. Englehard, and Soc. Automatisme et Appareillage. October 19th, 1917. (117,546.)

16,906. Thermo-electric generator. M. Peleumer. October 28th, 1916. (111,489.)

16,943. Electrically-heated sheets, rugs, mattresses, foot-warmers, and the like. C. S. Davidson. November 17th, 1917. (117,559.)

1918.

8,749. Terminal for the attachment of magnetic wires to sparking plugs of engines. E. Marazzi. March 21st, 1917. (116,496.)

Sweden.—Quite a number of companies, mostly small, have lately been formed in Sweden in connection with the supply of electricity for lighting and power purposes. Among them are the Landtbrukarna Elektrisk Aktiebolag, of Hallsberg, maximum capital, £28,000; the Asheda Electricitetsverk Aktiebolag, of Asheda, maximum capital, £2,800; the Massbacken Elektriska Aktiebolag, of Massbacken, maximum capital, £6,400; and the Edsbyns Electricitetsverk Aktiebolag, of Edsbyn, maximum capital, £3,400.